Reproductive Hazards at Work

Men, Women and the Fertility Gamble

Nancy Miller Chenier
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While the contributions leading to this report were significant, the responsibility for the shortcomings of the final text are, of course, entirely my own.

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I

REPRODUCTIVE HEALTH AND THE WORKPLACE

SETTING THE SCENE

A Many-sided Concern

Pierre and Marie, married four years, with a new house and savings in the bank, are eager to have children. Since Marie has already experienced two miscarriages, they are apprehensive when she becomes pregnant again, and they exercise great care to promote a full-term pregnancy. However, Marie miscarries for the third time. After unsatisfactory consultations with various health professionals, they hear of a physician noted for her success in fertility problems. She draws their attention to one precaution they failed to observe. They both continued to work at their regular jobs — Pierre as an anaesthetist spending many of his working hours in a poorly ventilated hospital operating room, and Marie as a scientist engaged in viral research in a

government laboratory. Both jobs involve potential reproductive hazards for men and women. Can these two workers continue at their jobs without further damaging their ability to produce healthy offspring?

Bill and a couple of co-workers at a local agricultural chemical plant start joking about the zero population growth in their families. As the conversation progresses, Bill admits rather hesitantly that he and his wife have been trying to conceive for over a year. His comments trigger a discussion that leads several other workers to talk about their lack of success in starting or expanding their families. Someone remembers a recent newspaper report suggesting that infertility could be linked to exposure to workplace chemicals. The workers eventually convince an independent physician to initiate medical investigation. The tests reveal that Bill and several other workers, employed steadily since the plant opened three years earlier, have abnormally low sperm counts which would make it virtually impossible for them to father children. The plant situated in a small community is a major source of employment. Although their union is willing to fight for improved hazard control, Bill and many of the affected workers know that the plant could be closed down if safety measures involve costly renovations. What are the options available to these workers?

Joan has worked with radiation-emitting diagnostic equipment since graduating as a radiology technician six years earlier. At a dinner party one evening, she talks to a young man who is employed as a control technician at the nuclear power plant that recently opened nearby. Intrigued by his description of the work and particularly by the salary levels, she decides to see if her work experience might be applicable. At the personnel office, she is informed that most jobs involving radiation are not available to women of childbearing capacity because of the danger of exposing a potential fetus. Remembering her years of potentially dangerous exposure to radiation in hospitals and health clinics, she is angered by the apparent double standard operating in this employment area. She resolves to fight her exclusion from the nuclear plant and to promote the need for workplace standards that will protect workers in all jobs involving radiation exposure. Where can she find support for her efforts to change the existing situation?

These three scenarios are representative of situations that many Canadians encounter regularly as a result of their work. At their workplaces, women and men alike may be exposed daily to conditions that can affect both their general health and their ability to produce healthy offspring. Identifying the hazard and establishing the link between certain workplaces and ill-health is usually not the end of the problem for those who are directly involved. In some cases, workers may have to make a choice between their health (including reproductive health) and their hourly wage. In other cases, certain workers may

be excluded from one hazardous workplace but may face the same hazard at another location.

This report aims to alert workers, policy makers, employers, union leaders, and health professionals to some of the issues surrounding reproductive health hazards in the workplace. It looks at the types of occupational hazards that affect reproduction, at the way they are identified and at their effect on workers. It examines the trend towards excluding women from certain workplaces. It explores some of the legal, economic and political concerns affecting the worker's right to a workplace free of reproductive hazards. It describes some of the initiatives taken by government and worker groups, internationally as well as nationally, and outlines some additional strategies that would reduce the serious problems caused by occupationally-induced reproductive impairment.

Why Reproductive Health?

A comprehensive assessment of the reproductive health of workers is overdue in Canada. Occupational hazards affecting reproductive ability are already numerous and new ones continue to be identified. Reproductive hazards are found in a variety of workplaces; are usually invisible; and their effects may not be documented for years. These hazards seldom limit their impact to workers of any particular sex, age, race, or physiological state. Although attention surrounding reproductive hazards has traditionally focused on pregnant females and developing fetuses, many such hazards are known to have a detrimental impact on males and nonpregnant females as well, often affecting their sexual performance as well as their fertility.

While all aspects of worker health should be considered in the establishment of safe workplaces, this document focuses only on the reproductive health of workers — the health of their reproductive organs, their ability to perform sexually, and if desired, to conceive and bear healthy children. Most of us are aware of the physical mutilation caused by unsafe machines and work practices and of the debilitating impact of occupational diseases such as asbestosis and radiation poisoning. Few of us suspect or feel affected by the less visible, but no less detrimental effect of reproductive hazards. For some, any discussion of the way workplaces affect reproductive health seems trivial in comparison to the cancer and crippling that can result from hazardous work. Unless the situation affects us personally, we adopt a "why should I care" attitude.

Yet, in many workplaces across Canada, in smelters, office buildings, textile factories, restaurants, chemical plants, laundries and numerous other locations, workers — friends, neighbours, family

members and maybe even you — are confronted daily by hazards that can have an adverse effect on reproductive ability. As is so often our tendency, we try to ignore the facts on workplace hazards and often succeed — until we find ourselves directly involved. Then, any figures on probability of harmful exposure become inconsequential and for the affected person, the probability becomes a reality of 100 per cent.

For the affected worker, male or female, the consequences are serious. Impaired sexual functioning, sterility, miscarriage, offspring with physical defects, perhaps with an increased propensity for childhood cancer — these and other serious health problems can result from exposure to toxic chemicals, dangerous substances and other adverse conditions found in the workplace. The need to identify the effects of workplace pollution on men and women and their offspring is evident. Thousands of workers are encountering daily either one or a combination of hazards that may affect their reproductive health. Like the caged canaries that once warned coal miners of the presence of deadly gases, today's workers often serve as early warning systems for hazards that will eventually affect society as a whole. In the workplace, the battles are waged between hazards and human health. In the end, all of society may be the loser.

How Do Workplace Hazards Affect Reproduction?

Reproductive hazards have a long history within the more general field of occupational health. In 1775, when Percivall Pott observed the link between cancer of the scrotum in London chimney-sweeps and their daily exposure to coal tar, he was identifying an occupationally-induced cancer that directly affected the reproductive systems of the young male workers.[1] In the 1850s, when Constantin Paul studied French workers who were exposed to lead, he noted that both men and women were at risk, with a higher rate of miscarriage occurring among the families of exposed workers.[2] Soon after the discovery of X-rays in 1895, radiation was observed to be capable of harming the genetic material of cells. Later studies noted that fetal cells were acutely sensitive but that radiation could also affect fertility in men.[3]

These are just a few examples of the known reproductive hazards associated with work. While more detailed information on specific hazards is given in a later section of this report, the following discussion summarizes the many ways that reproductive health can be impaired. Because the terms *mutagenesis, teratogenesis and carcinogenesis* are used occasionally throughout this report, they are described briefly in the following paragraphs. Readers who want a fuller description of the male and female reproductive process and of the numerous scientific terms associated with reproductive health are referred to other sources.[4]

Mutagenesis occurs when the genetic material of living cells, the genes or chromosomes that determine heritable characteristics, are changed by exposure to a specific hazard or combination of hazards. The change, or mutation, can occur in the sex cells of either the sperm or the ovum prior to fertilization. Mutations may be fatal to the developing human organism, causing the sperm or ovum to fail in the fertilization process or the embryo or fetus to be aborted by the body or to die in the uterus. Mutations that are not fatal *in utero* may result in newborns with gross structural defects such as deformed limbs or malformed organs. Other mutagenic effects, such as mental retardation or blood disorders, may be less easy to discern immediately after birth. Some mutations become apparent years later, possibly as a form of cancer, or they may be accumulated and passed on to future generations.

Teratogenesis usually describes the process whereby the developing embryo, fetus or newborn is exposed to environmental conditions that can adversely affect its development. Certain hazards called teratogens may act on the immature cells and tissues of an embryo or fetus, altering their growth pattern and causing physical abnormalities, or they may interfere with certain chemical reactions which are essential for normal development. Teratogens may enter the mother's body without harming her but may result in miscarriage, birth defects, or developmental problems for her offspring. While certain chemicals and viruses present in the mother's system during pregnancy account for many abnormalities in the fetus or newborn, research now suggests that contaminated seminal fluid from the male as well as physical conditions of noise and temperature may also act as teratogens.

Carcinogenesis refers to the phenomenon whereby exposure to certain substances or conditions results in an increased incidence of cancerous tumors. Workers may exhibit an increased rate of cancer of the reproductive organs. Transplacental carcinogenesis refers to the increase in tumors in offspring who are exposed prenatally to a carcinogen. For example, exposure of the developing fetus to either vinyl chloride or diethylstilbestrol has been linked with a higher incidence of cancer in later years.

The effect of workplace hazards on reproductive health depends on a number of factors including the type of hazard, the duration, level, and mode of exposure, the health and genetic makeup of the individual worker, and the way the hazard interacts with other substances in the workplace. A person with healthy reproductive functioning will have the unimpaired ability to perform sexually and if desired, to produce normal and healthy children. Not all workers enter the workplace in this state of reproductive health: some were born with reproductive problems, and others have acquired problems elsewhere.

However, exposure to workplace conditions, processes, or substances should not further aggravate existing reproductive problems and should not be responsible for the creation of new ones. Ideally, every worker should be assured that the various stages of the reproductive cycle — from the production of the sperm and ova, through fertilization, implantation, embryal and fetal gestation, to the postpartum development of the newborn — will be unaffected by their work.

Men As Well As Women At Risk

Until the mid-seventies, reproductive studies tended to focus almost exclusively on maternal exposure to toxic agents or hazardous conditions during pregnancy. Paternal exposure and pre-pregnancy maternal exposure were seldom explored. However, recent work by concerned scientists and other members of the occupational health community has led to a fuller understanding of the reproductive effects on all workers. In the United States and Canada, throughout Europe, Asia and other parts of the world, many people have been instrumental in bringing these research findings to the attention of the public.[5] The following information is selected from a variety of these sources.

In males, human studies have identified several direct effects on their reproductive abilities and systems: loss of libido, impotence, sterility, abnormally-shaped sperm, atrophy of the testes, enlarged mammary glands, decreased number and movement of sperm. Other effects have been demonstrated through the female partners and offspring of exposed male workers: increased incidence of miscarriages, stillbirths or congenital abnormalities, including offspring with physical defects and increased susceptibility to childhood cancer.

Animal studies have confirmed all these effects on the male reproductive system, and disclosed more: damage to blood vessels in the testes; destruction of the seminiferous tubules, which produce and nourish the reproductive cells; degeneration of the testes; increased hormone levels; changes in chromosomes. The majority of these adverse effects are linked to chemical and physical agents. However, biological and psychosocial hazards can also negatively affect the male and female reproductive systems.

In the female, human and animal studies have identified reproductive effects ranging from suppressed or irregular menstruation, defective ova, and unsuccessful implantation of fertilized ova through to embryonic, fetal or birth defects and problems with lactation.

Any of these effects may result from the action of toxic substances or dangerous conditions on the female worker's ovum, the male worker's

sperm or the developing fetus. Each is susceptible at varying stages of reproduction. The ovum and sperm, for example, are vulnerable up to conception. The fertilized ovum is then at risk as it goes through the process of growth and differentiation into an embryo (approximately 4 weeks). The embryo can be exposed until it develops into a fetus in the third month and the fetus until it becomes a full-term infant at nine months. However, it is generally believed that the human organism may be most susceptible to outside influences during the stages of organ development. This period of development usually lasts from about the eighteenth day to the sixtieth day after conception, with the greatest sensitivity believed to occur between the twentieth and thirtieth days.

The following table, adapted from similar work by Hricko and Penney, illustrates four key points when exposure to workplace hazards may adversely affect the reproductive process.[6]

PRIOR TO CONCEPTION	Exposure of male or female workers to hazards may lead to hormonal changes, interference with sexual functions, cancer of the reproductive organs, lowered fertility or sterility, mutations or genetic change in sperm and ova. Women may also experience menstrual disorders.
AT CONCEPTION	Workplace hazards can create difficulties in conceiving a child by interfering with the sperm's ability to fertilize the ovum, by upsetting the hormonal balance, by contaminating the fertilized ovum before attachment to the uterine wall.
DURING PREGNANCY	The work environment can cause miscarriages, stillbirths, cancer, disease, or birth defects. Potentially hazardous agents such as chemicals and viruses may enter the mother's body, cross the placenta and reach the developing fetus. Agents like radiation may affect the fetus directly. Physical working conditions involving noise, temperature extremes, occupational stress may affect the health of the mother and through her, the development of the fetus. Other hazards may affect the oxygen-carrying capacity of the mother's blood, resulting in a negative impact on the fetus.

POST PREGNANCY	Development of the newborn may be affected as a result of infectious agents contacted in the birth canal or because of chemicals transmitted to the child in a mother's breast milk. A child may be affected by exposure to substances emitted into the environment surrounding a workplace or carried home on a parent's clothes.

The Scope of the Problem

Pinpointing the number and type of workers at risk and determining the incidence of exposure requires a more continuous and coordinated system of data collection and analysis than currently exists in Canada. While the need for such a national information base on occupational health concerns has been recognized for years, attempts to establish one have been largely unsuccessful.[7] Since its formation in 1979, the Canadian Centre for Occupational Health and Safety has made tentative gestures indicating interest in this area. However, efforts continue to be complicated by a number of diverse factors: uncertainty about federal and provincial/territorial jurisdictional authority, lack of funding, limited access to existing health records, inadequate information in medical histories, and workers' fears about loss of privacy and dismissal on health grounds.

At the present time, statistics on occupational disease come primarily from government bodies such as provincial workers' compensation boards and labour or health departments. Traditionally, the reporting focus has been directed toward accidents and injuries, with job-related ailments, particularly reproductive problems, receiving little or no attention. Significantly, although an increasing number of employment directives exclude fertile women from specific jobs, it is impossible to obtain the accurate statistics needed to determine how many Canadian women are currently or have been in the past employed during pregnancy. In addition, the type of work they and their male partners do as well as the state of their health before, during or after employment remains largely unknown.

Specific information on the incidence of worker exposure to reproductive hazards is not easily obtained, but some estimates of the numbers potentially at risk can be drawn from labour force statistics on specific industries and occupations. Two tables showing the employment distribution of Canadian workers by sex in various industrial and occupational groups are reproduced as Appendices. More specific data on the number of workers in certain industrial subsectors and occupations must be pulled from a variety of sources.[8]

Thus, when the existence of a hazard or hazards is identified for a particular type of workplace, the process of analyzing all available sources to determine the population at risk from each hazard is currently a cumbersome and time-consuming process. Although the Canadian Centre for Occupational Health and Safety does collect and analyze some data on occupational health, a statistical base on hazard exposure in Canadian workplaces is not yet a reality. However, some numerical estimates of the men and women potentially exposed to specific reproductive hazards have been determined and will be noted at relevant spots throughout this report.

Action Is Needed Now

The detrimental impact of workplace toxins and conditions on future generations is difficult to quantify in specific numerical terms for the reasons given above. In addition, the medical and scientific communities have made few efforts to link the incidence of miscarriages, stillbirths, birth defects, neonatal deaths or other reproductive problems with parental work histories. While public and professional interest in prenatal care for pregnant women appears to be extensive, the focus is primarily on lifestyle education and counselling for the expectant mother and virtually ignores the effect of daily work conditions.

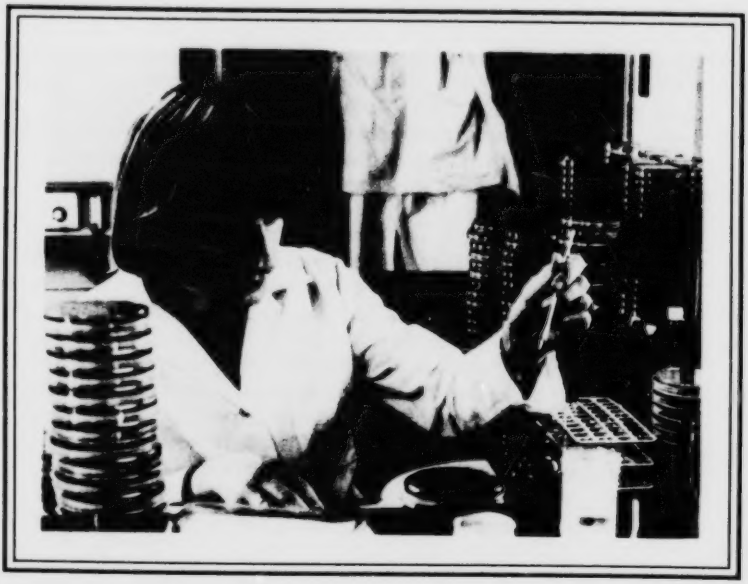
Concern for the prevention of handicaps has yielded some figures that are relevant to this debate.[9] In Canada, a conservative estimate of the number of newborns with visible handicaps is placed between 3 to 4 per cent annually of all live births. This number does not include those born with physical or developmental defects that can remain undetected for months or even years; the inclusion of these problems could push the rate closer to 10 per cent. An estimated additional 10 to 15 per cent of pregnancies end in stillbirths or in miscarriages. As many as half of the miscarriages may be associated with chromosomal abnormalities, some of which could be the result of harmful substances encountered by the father or mother. Other less visible reproductive problems may be on the increase as well; according to current estimates, one out of four married couples are troubled by some degree of infertility and one out of seven may be unable to conceive.

The subject of reproductive health cannot be taken lightly. The impairment of any aspect of the reproductive functioning of men and women is a serious matter involving high costs for the whole society. In social terms, the cost of mental anguish because of impotency, because of inability to conceive, because of a defective child is impossible to quantify. In economic terms, the cost of medical treatment for the affected worker, of days lost through related illness, of long-term care for a child with birth defects can be enormous. The reproductive health

of all workers must be of concern not only to the occupational health community, but also to all members of society.

II

KNOW YOUR ENEMY



WORKPLACE HAZARDS AFFECTING REPRODUCTION

Hazards that affect not only the general health of workers, but also their reproductive health are numerous and widespread. This chapter discusses four major categories of hazards — chemical, physical, biological and psychosocial — and specifically identifies some potential reproductive hazards. In addition, through the use of selected examples, it looks at the problems associated with their identification and control in Canadian workplaces. In particular, it highlights the need for greater vigilance over the health and safety of all workers and the importance of expanding the focus on reproductive concern to include men as well as women.

CHEMICAL HAZARDS

Chemicals in their most elementary state as well as the compounds formed from these elements are used in virtually all manufacturing processes across the country. Outside of industrial worksites, chemical hazards (see Table A)[10] affect male and female workers in health care facilities (anaesthetic gases, solvents, medications), in offices (photocopy chemicals, erasing fluids), in schools (asbestos, cleaning solutions), in parks (pesticides, water purifiers) and numerous other workplace environments. Women working at home use chemical products for cleaning floors, painting walls, glueing broken toys, fertilizing plants, eradicating pests, refinishing furniture and for many of the other activities that fill their waking hours. Residents in communities surrounding industrial sites may inhale the discharged chemicals in the air they breathe and may ingest them through contaminated water and food products.

Chemical substances can invade the body through inhalation, ingestion and/or absorption and can create serious health problems for affected workers. They cause skin irritations and ulcerations of the mucous membranes. They accumulate in the liver, kidneys, lungs, stomach and other organs, causing irreversible damage. They are implicated as cancer-causing agents. They result in menstrual disorders in women and impotency in men. They affect the production of sperm and ova in workers, leading to infertility or sterility. They prevent the implantation of fertilized ovum, resulting in the reabsorption of the conceptus into the mother. They interfere with the normal growth and development of the embryo and fetus. They cause mutations that are transmissible from one generation to the next.[11]

Fears that daily exposure to certain chemicals may lead to any one or several of these problems are not unjustified. Although serious attempts are being made to acquire greater knowledge about chemical hazards and to ensure their control in the workplace, the current situation is still fraught with difficulties. A cursory look at the enormous but essential task of pretesting chemicals and ensuring their regulation before their introduction into the work environment illustrates part of the predicament.

As the chemical industry continues to expand and to produce new products, the magnitude of the problem increases. One 1976 estimate suggested that of the more than 400,000 chemical products used in world industry to that date, only 13,000 had been examined and classified by the United States National Institute for Occupational Safety and Health (NIOSH) while only 400 were covered by U.S. occupational health standards.[12] In occupational health and safety matters, Canada relies heavily on information generated in the U.S. for both safety assessment and regulation.[13]

The way chemicals are tested and regulated requires careful study and action. Toxicologists who evaluate the effects of chemical contamination often study a single chemical at a time, working with high levels of the substance to establish short-term, acute effects. By contrast, chemical contamination, either in the workplace or through spills into the environment, may consist of several chemicals interacting together or may result in continuous low levels of exposure which eventually lead to long-term chronic effects or cancer.[14] For the protection of workers, factors such as individual susceptibility, cumulative and synergistic effects, duration of exposure, and frequency of high concentrations need to be considered when establishing occupational exposure standards. In addition, to identify and control potential reproductive hazards, all chemicals should be screened for teratogenicity, mutagenicity, carcinogenicity and for effects on nursing infants before approval is granted for workplace use.[15]

The following short case histories give some indication of the lengthy and often inconclusive battle to ensure the health and safety of workers exposed to chemical substances. They describe some human implications of exposure to reproductive hazards. They point out the way that our industrialized society daily places workers' health and the health of their offspring in jeopardy. These five cases share several common features: they are based on real life situations involving workers; they are situations that existed for decades and in some cases continue to this day; they have a detrimental effect on the health of future generations. With the exception of the pesticide, DBCP, which has to date affected only male workers, all the chemical substances have demonstrated effects on the reproductive systems of male and female workers.

Anaesthetic Gases: The Ongoing Debate

Anaesthetics, used increasingly over this century, are still generally considered safe for the intentional acute exposure of hospital patients. However, observations over several decades have uncovered serious chronic health effects, including reproductive ones, related to prolonged occupational exposure of hospital staff. Debate over the extent of health problems caused by anaesthetics has raged since the late 1960s when Russian, Danish, and Hungarian studies first raised questions on this issue.

In addition to reporting an unusually high incidence of headache, fatigue, and irritability in exposed workers, two of these studies noted that a high percentage of pregnancies among female anaesthetists ended in spontaneous abortion.[16] Vaisman, who followed thirty-one pregnant anaesthesiologists, found that more than half (18 of 31) of the subjects aborted. Askrog and Harvald found a 20 per cent abortion rate among the experimental group compared with 10 per cent of the

TABLE A

Some Chemical Hazards That May Affect Reproductive Health

Hazard	Workers At Risk	Potential Reproductive Effect	Protective Measures
Anesthetic Gases (including halothane, nitrous oxide, methoxyflurane)	health care workers in hospitals and dental clinics, veterinary surgeons and assistants, researchers in animal laboratories	male workers: sperm abnormalities; wives female partners of exposed male workers may experience an increased incidence of miscarriages, premature deliveries and offspring with birth defects; female workers: same as wives female partners of male workers; the fetus: birth defects	install scavenger units to collect stray gases; monitor air in operating theatre to ensure low levels
Benzene	workers producing or using solvents, plastics, rubbers, glues, dyes, detergents, paints, petroleum and other products containing this substance	male and female workers: chromosome changes, linked with leukemia and genetic effects in offspring; female workers: prolonged menstrual bleeding and postpartum hemorrhage after chronic exposure; the fetus: birth defects, higher incidence of leukemia, illness from contaminated breast milk	substitute non toxic or less toxic products; take regular workplace air samples; ensure proper ventilation and safe engineering processes
Beryllium	ceramic makers, electronics workers, jewelry makers, laboratory workers, nuclear technologists	female workers: pregnancy may exacerbate symptoms of beryllium poisoning and cause death; the fetus: may cross placenta and affect fetal development	monitor workplace levels regularly; install proper ventilation and dust collection devices in the work environment
Carbon Disulfide	degreasers, glue makers, paint removers, rubber makers, rayon viscose makers	male workers: decreased libido, impotence, sperm abnormalities; female workers: irregular menstrual cycle, decreased fertility, frequent miscarriages; the fetus: higher incidence of miscarriage	monitor workplace levels and reduce to minimum; ensure that prolonged worker exposure is prohibited
Hormones (including androgens, estrogens, progestogens and synthetic products such as DES)	workers involved in the extraction, manufacture and use of hormones including pharmaceutical workers, laboratory workers, farmers and veterinarians	male workers: sexual impotency, breast enlargement, infertility; female workers: irregular menstruation, infertility, ovarian cysts, breast lumps, cancer of the reproductive system; the fetus: may develop enlarged breasts and other signs of	monitor regularly to ensure low levels of airborne hormones; isolate the process through engineering design

		sexual maturity as well as abnormalities of the skeletal system, heart and windpipe; DES may cause cancer in female offspring, genital and sperm abnormalities in male offspring	
Lead	auto manufacturers, ceramic and pottery makers, electronics workers, farmers, pesticide makers, paint makers and users, typographers	male workers: decreased libido, decreased sperm count, atrophy of the testes; wives/female partners demonstrate adverse effects such as infertility, menstrual disorders, miscarriages; female workers: infertility, miscarriages, stillbirths, menstrual disorders; the fetus: higher incidence of miscarriages, stillbirths, neonatal death; mental retardation can occur; newborns can be affected by contaminated breast milk	sample workplace air frequently; provide adequate ventilation; clean work areas regularly
Mercury	battery makers, ceramic workers, commercial fishermen, dental workers, farm workers, jewelry makers, lithographers, pesticide makers, photographic chemical makers and users	male workers: reduced fertility; female workers: miscarriages, stillbirths; the fetus: linked with severe brain damage, mental retardation, increased rate of miscarriages and stillbirths	regular air monitoring and good ventilation; enclose mercury processes; check frequently for spills and vapour leaks
Pesticides (including carbaryl, dibromochloropropane, kepone, malathion, 2,4,5-T)	agricultural workers, commercial and household gardners, pesticide manufacturers	male workers: chromosomal changes, impotence, loss of libido, decreased sperm counts, atrophy of the testes; female workers: miscarriages, chromosomal changes; the fetus: miscarriages, birth deformities	design processes to prevent worker contact with substance; monitor air levels in workplace and keep to a minimum
Vinyl Chloride	workers involved in the production of vinyl chloride and polyvinyl chloride and its related products	male workers: genetic damage of the sperm leading to adverse pregnancy outcome in wives/female partners; female workers: genetic damage to ovum, miscarriages, stillbirths; the fetus: higher incidence of miscarriage, fetal death and birth defects; may develop cancer after exposure during pregnancy	monitor workplace regularly; use proper ventilation and safe design to keep levels at a minimum

control. When the wives of male anaesthetists were observed, a higher incidence of abortion was evident in this group as well.

Researchers in the United States and in the United Kingdom, stimulated by these findings, initiated major studies within both countries during the 1970s. Cohen and associates at Stanford Medical Center in the U.S.A. reported significantly higher abortion rates among both female anaesthetists and operating room nurses.[17] Knill-Jones and colleagues in Ireland observed a higher incidence of spontaneous abortion for female anaesthetists but no significant increase for wives of male anaesthetists.[18]

In 1974, a large-scale national study jointly sponsored in the U.S.A. by NIOSH and the American Society of Anaesthesiologists (ASA) was released. The results showed that female staff had an increased risk of spontaneous abortion, of bearing children with congenital anomalies, of cancer, and of liver and kidney disease. In addition, the offspring of male anaesthetists (when compared with those of unexposed medical personnel) were shown to have a higher rate of birth defects.[19]

A 1975 report by the same group, based on a survey of general dental practitioners and oral surgeons, indicated a significantly higher rate of liver disease among the respondents as well as an increased rate of spontaneous abortion among their wives, 1¼ times higher than the wives of unexposed dentists.[20]

Major Canadian hospitals have responded to the situation by installing scavenger units, which collect the waste gases in the operating rooms and send them outside through exhaust systems. Smaller hospitals with limited resources may find it more difficult to do the same. Because hospital workers are exposed to a multiplicity of hazards — radiation, chemical solvents, biological agents, fatigue — isolating waste anaesthetic gases as the cause of specific reproductive ill-health is difficult. However, a growing body of scientific evidence suggests that anaesthetics are the most likely culprit in a great number of cases and thus must be given serious attention.

Pesticides: The Story of DBCP and Sterility

Dibromochloropropane or DBCP was made available for agricultural use in the 1950s. As a pesticide, this chemical substance was formulated to kill the small parasitic worms or nematodes that burrow into the roots of plants. It has been applied on such crops as citrus fruits, grapes, peaches, soybeans and bananas.

In 1961, a study of DBCP reported that it was a mild irritant and a liver and kidney toxin. In addition, the report noted that it had produced testicular atrophy and sterility in several species of experimental animals.[21] In 1973, a study by the U.S. National Cancer Institute

pointed out that DBCP was one of several fumigants that caused not only stomach cancer in rats and mice but also mammary tumors in female rats.[22] In 1975, a study using bacterial systems reported that it was mutagenic, a finding that should have led to caution and more intensive study of its effect on humans.[23]

Meanwhile, at the Occidental Chemical Company plant in Lathrop, California, male workers in the agricultural chemical division were making tentative lunchroom jokes about the obvious lack of pregnancies among workers' families. Although for several years their work conditions were suspected to be linked to the problem, it wasn't until July, 1977, that the men were persuaded by the union to undergo semen analysis and other tests.

Of the 36 male workers who participated in the initial study, 11 had previously undergone vasectomy, 11 demonstrated extremely low sperm counts of less than one million per ml., 11 had normal sperm counts of over 40 million and 3 showed counts of between 10 million and 30 million.[24] When the very low and the normal sperm count groups were compared in terms of variables such as age, length of employment and hormone levels, the most striking observation involved length of time in employment. Low sperm count workers had an employment exposure history of at least three years while none of the normal sperm count workers had been exposed for more than three months. Although the plant used many different chemicals in their products, the study concluded that the existing evidence pointed to DBCP or dibromochloropropane as the offending agent.

After the study results confirming worker sterility were released, three U.S. federal agencies — the Environmental Protection Agency (EPA), the Occupational Safety and Health Administration (OSHA), and the Food and Drug Administration (FDA) — combined their powers to impose emergency restrictions on the production, distribution and use of the pesticide. This action met resistance from several groups.

It brought the following response from at least one national agricultural group. This excerpt is part of a letter sent to Dr. Eula Bingham of OSHA from Robert K. Phillips of the National Peach Council:

> *If possible sterility is the main problem, couldn't workers who were old enough that they no longer wanted to have children accept such positions voluntarily? Or could workers be advised of the situation, and some might volunteer for such posts as an alternative to planned surgery for a vasectomy or tubal ligation, or as a means of getting around religious bans on birth control when they want no more children.*[25]

Follow-up studies on the pesticide through 1977 and 1978 supported earlier reports that the testes is one of the target organs of DBCP, causing sterility and other side effects in workers. In October, 1979, the use of DBCP was banned in the U.S. In Canada, DBCP was used as a preplanting soil fumigant for certain highly-valued fruit and vegetable crops until 1977 when, after increased reporting of health side effects, the supply of the product was stopped by the distributor, Shell Canada. The stock of DBCP on the inventories of Canadian companies at that time continued to be sold to consumers until it was reportedly used up in 1978.

Diethylstilbestrol (DES): An Uncontrolled Human Experiment

> *Our union represented the all male work force at what I believe is the only DES manufacturing facility in the United States... In extensive interviews with the 18 men directly exposed to DES in operations and shipping, we found that 9 of these showed symptoms of DES absorption in that they had fairly well developed breasts and were losing their body hair. In fact, 1 of the 9 men had undergone an operation to have his breasts cut and 3 of the men reported libido problems and may well be impotent. The problem is not a new one in this plant, the plant has been operating for over 10 years and the company knew of this devastating damage to its employees at least five years ago.*[26]

The administration of diethylstilbestrol (DES), a synthetic estrogenic hormone, to countless numbers of pregnant women from the 1940s up to the 1970s has resulted in tragedy for many of their offspring, a situation reminiscent of the thalidomide story. Since it was first marketed in 1938, DES has been administered to thousands of women in attempts to prevent miscarriage[27]; has been used as a "morning after" pill by countless others trying to prevent implantation of a fertilized ovum[28]; has reached both males and females through ingestion of meat products from livestock whose growth was stimulated by the chemical[29]; and has affected many workers involved in the manufacture of estrogenic compounds.[30]

DES, when absorbed by pregnant women, may lead to vaginal cancer, abnormalities of cervical and vaginal tissues or infertility in the female offspring,[31] and sperm abnormalities, shrunken testes, small penises and epididymal cysts in the male.[32] In 1971, after the first cases of clear-cell adenocarcinoma (a previously rare cancer of the vagina) were reported in the medical literature, the scientific community took note of the first demonstrated transplacental carcinogen in human subjects.

Although experiments with estrogens in the late 1930s and early

1940s had indicated some potential health problems for humans, they continued to be manufactured and administered.[33] Medical practitioners heartily endorsed the use of DES as an inexpensive, effective and easily administered treatment. In 1971, after its adverse effects became evident, W.D. Holsten noted that although DES had been widely used for decades:

> *I cannot find reported in the medical literature any well-controlled scientific studies conducted to prove the safe and effective use of diethylstilbestrol in any dose or duration for treatment...*[34]

While much of the literature and as a consequence, much of this discussion focuses on DES, the exposure of workers to other synthetic estrogens in drug manufacturing facilities, in laboratories and in related livestock situations merits greater attention. Symptoms experienced by workers in a DES facility in the United States[35] have also been reported by Canadians working with ethinyl estradiol. In 1979 at a Wyeth Ltd. Pharmaceuticals plant in Windsor, Ontario, male workers reported breast growth and impotence while female workers reported erratic vaginal bleeding and infertility.[36] This is not the first estrogen-related case of occupational ill-health in Canada. In the early 1950s, several cases of painful breast enlargement in males were reported in a Charles E. Frosst drug manufacturing facility and were linked to estrogen sulphate.[37]

In 1973, the Canadian government suspended the use of DES as a growth promotant and shortly thereafter, the importation of meat produced with DES was banned. Although contraindicated during pregnancy, the drug continued to be available for the use of medical practitioners.[38] On the question of other synthetic estrogens commonly used in birth control pills and particularly on the need for more stringent exposure levels, Canadian authorities have been strangely silent.

Lead: Danger Inside and Outside the Workplace

Lead is one of the oldest known occupational hazards. Hippocrates in 370 B.C. described symptoms of lead colic in a worker who extracted metal. Pliny the Elder, a Roman senator, warned against the toxicity of lead in the first century A.D. The association of lead with adverse effects on reproduction has also been suspected since Roman times. Some speculate that the fall of the Roman Empire may have been partly due to the use of lead as a sweetener of wine, thereby decreasing the fertility of the ruling class as well as resulting in unhealthy offspring.[39]

A study by Constantin Paul in 1860 was an early attempt to document some of the reproductive effects of lead exposure;[40] over the next century, many others followed. The biggest dispute centres around

Thank God! The women and children are safe from lead poisoning

the findings on female versus male risk. Paul had reported that when either parent was occupationally exposed to lead, the rate of miscarriage was higher than in the unexposed population. Similar results have been documented by other scientists in more recent times[41] but nonetheless the effects of exposure on both male and female workers continue to be debated.

In Canada, the number of male and female workers exposed to lead has not been estimated. However, a 1977 report pointed out that Canada was a major producer of lead ore (ranking second in world production) and of refined lead (ranking sixth).[42] Workers involved in mining, smelting and manufacturing are exposed. Lead oxides used in storage batteries, lead pigments used in paints, tetraethyl lead used in gasoline, and lead compounds used in plastics are but a few of the exposure sources for workers. Small industries involved in recycling lead often pose serious problems for workers.

Although most major industrial employers have installed some form of control technology to reduce lead emissions both within and outside their operations, lead continues to be a serious occupational and environmental hazard for Canadians. In Toronto, the Canada Metal Co. Ltd. recently drew criticism from the Ontario Ministry of the Environment for their apparent disregard of high level lead emissions around their plant. The company, which has been at the centre of

environmental controversy in Ontario since the early seventies, claimed to have invested close to $2-million for control technology. The Ministry, which had taken air samples over a three month period, called their efforts inadequate and sloppy.[43] Meanwhile, the workers within the plant and residents of the community surrounding the plant continued to breathe air polluted with lead particles.

In Winnipeg, Manitoba, controversy over workplace and environmental lead levels has been building since the mid-seventies.[44] Workers at four smelters in the city experienced dangerously high lead levels in their blood. Many required chelating or deleading treatments; others were referred for Workers' Compensation. Government readings during regular inplant inspections showed levels up to 50 times higher than threshold limit values. At the same time, children at nearby schools and persons eating vegetables from gardens in the vicinity of the plants were also exposed to dangerous levels.

Governments react to these events by conducting numerous tests of workplace and environmental air levels: then, when the situation seems to have gone a bit too far, they issue stop-work orders, leaving workers without jobs or financial security. Penalties to companies for non-compliance are rare. Industries, in the meantime, continue to emit lead into the air. When necessary, they may give employees medication designed to reduce blood lead levels or they may simply remove them from the workplace until blood levels are once again acceptable.[45] Where female workers are involved, they may deny them employment unless they can prove sterility.

Vinyl Chloride: The Workers Are the Last to Know

> *Viewed holistically, the claim that the vinyl chloride story is a success becomes rather dubious. It has long been known that nearly all halogenated hydrocarbons represent a hazard to human health. In 1949, 1958 and 1965 reports from the Soviet Bloc revealed a variety of disorders in workers exposed to VCM; in the mid-1960's a number of reports dealt with changes in VC reactor cleaners; in 1970, Dr. Viola reported that vinyl chloride caused a cancer in animals. Despite these reports, up to 1973, it was the general conclusion that exposure to VCM was not a serious health hazard.*[46]

Vinyl chloride monomer (VCM) is used to produce polyvinyl chloride (PVC) resins which are in turn used to make a wide variety of plastic products. Curtains, phonograph records, floor tiles, household appliances, cushions, food wrap, electrical wire insulation, gas and oil pipelines, and window frames are but a few of the possible variations. First produced on a wide scale in Germany during the 1930s, polyvinyl chloride was for several decades considered to be one of the safest chemicals in use.

In January, 1974, B.F. Goodrich announced that three of their workers at a plant in Louisville, Kentucky had died of liver cancer, angiosarcoma, caused by exposure to vinyl chloride. A worldwide search for other victims of this occupationally-induced disease had by March, 1976 revealed forty-eight cases of VC-related liver cancer. Ten of the affected workers, almost 20 per cent, were in Canada; nine of these worked in one plant in Shawinigan, Quebec.[47]

The production of vinyl chloride monomer and polyvinyl chloride in Canada does not involve a lot of workers. A 1976 estimate suggested that only 550 people were employed within the actual plants, while 1,426 were in supporting offices. However, in related plastic fabrication processes using polyvinyl chloride, the number of workers is higher, an estimated 50,000 in Canada.[48] This latter category and the office staff of production plants include a large proportion of female workers.

In 1970, an extensive study of vinyl chloride-induced cancer was undertaken by Dr. C. Maltoni, who was supported by the Manufacturing Chemists Association, Montedison, Imperial Chemical, Solvay, and Rhone-Prolig. The agreement was made that experimental results would be shared by these groups but not revealed to the public or to workers without their consent. By 1972, test results showed a definite link between vinyl chloride exposure of varying doses and tumors in the rats, mice and hamsters used as experimental animals. In addition, Maltoni demonstrated the likelihood of transplacental cancer in offspring as a result of vinyl chloride exposure *in utero*.[49] This knowledge did not come into the public domain until after the B.F. Goodrich acknowledgement of the problem in their Louisville, Kentucky plant in 1974.

Epidemiological studies carried out in the mid-seventies reported that children born in U.S. communities surrounding vinyl chloride facilities had an increased incidence of birth defects, particularly those of the central nervous system.[50] In Canada, one source has reported that there may be a higher than normal incidence of birth defects around the Shawinigan plant in Quebec.[51] Some researchers have suggested that the adverse effects may be transmitted through either parent.

In Canada, most provincial governments are working towards establishing lower exposure limits. While several governments (B.C. and Quebec, for example) are proposing a standard of 1 ppm (part per million) over 8 hours of exposure, others such as Ontario and Alberta accept a slightly higher level in the workplace. However, as many experts agree, since there is no safe level of exposure to carcinogens, even 1 ppm leaves many workers at risk.

PHYSICAL HAZARDS

Physical hazards (see Table B)[52], the most widely reported of all occupational dangers, include noise, vibration, temperature extremes, ionizing and non-ionizing radiation. Efforts have been made to establish guidelines for many of these hazards, but major work is still required. Research evidence suggests that all of these factors may have a negative impact on reproductive functioning in male and female workers. Noise and vibration, which were once thought to produce ill-effects only at very high levels, are now considered by some researchers to present problems at low ranges as well. Recent work suggesting that cold, humid work environments can have a negative impact on the reproductive health of workers complements the research work focusing on heat as a reproductive hazard.[53] However, with the exception of ionizing radiation, research on the reproductive impact of all physical hazards is more limited than for chemical hazards.

Estimates for the number of workers exposed to most of these hazards simply do not exist. Hot and cold temperature extremes, noise, and vibration are part of many jobs. While the use of devices employing non-ionizing radiation is increasing rapidly, no requirements exist in Canada for regular monitoring of exposed workers. In addition, while some workers exposed to ionizing radiation may participate in the voluntary dosimetry service provided by the Radiation Protection Bureau of Health and Welfare Canada, it is not a requirement for all categories of workers.

Ionizing Radiation: Some Thoughts on the Employment of Men and Women

Some employers in the Canadian nuclear industry have refused to hire women of childbearing capacity. Their action is based on Atomic Energy Control Board (AECB) regulations, which currently place specific limits on the abdominal radiation dose permitted for any "female radiation worker of reproductive capacity".[54] All radiation workers may receive up to 5 rems during a year. Although regulatory changes are proposed, at present the maximum permissable abdominal dose for fertile women is 0.2 rem per 2 weeks or 1.3 rems per quarter of a year, while fertile male workers may receive up to 3 rems per quarter. The intention is to spread the dose for women more evenly over the year in order to provide some degree of protection for an undetected pregnancy.

Studies of human and animal offspring irradiated during pregnancy do indicate that the developing fetus is particularly susceptible. Animal studies conducted in 1907, shortly after the discovery of X-rays, revealed that female rabbits exposed to X-rays during pregnancy produced offspring with cataracts and eye defects.[55] In the 1920s, a study

TABLE B

Some Physical Hazards That May Affect Reproductive Health

Hazard	Workers At Risk	Potential Reproductive Effect	Protective Measures
Ionizing Radiation	atomic radiation workers, dental and chiropracter office workers, hospital employees, scientists	male and female workers: sterility, premature aging of the sex cells, altered genetic material; the fetus: damage resulting in prenatal death, mental retardation, birth defects, increased incidence of leukemia and other cancers	reduce workplace levels to a minimum; use proper shielding techniques; monitor individual exposures using filmbadge dosimeters and other mobile measuring devices; leave contaminated workclothes at the worksite; maintain exposure records for workers
Noise and Vibration	assembly line workers, airline attendants, construction workers, garment and textile workers, machinists, motor vehicle drivers, pneumatic drill operators	male workers: sexual dysfunction and decreased fertility; female workers: disturbances of the menstrual cycle, increased rate of premature births and complications during labour; the fetus: disturbances of uterine circulation in the mother may lead to miscarriage, low birth weight, perinatal mortality	design machines to ensure minimal noise and vibration; use proper preventive maintenance for equipment; isolate noisy processes using noise absorbing partitions; use sound and vibration absorbing material in floors, walls and ceilings; install mufflers on all motorized equipment, provide frequent rest periods and job rotations to decrease worker exposure
Non-ionizing Radiation	flight attendants and pilots, food service workers, health care workers, radio navigation and radar communication workers	male workers: degeneration of the testes, decreased libido, lower sperm count and motility, abnormally shaped sperm; female workers: changes in menstrual cycle, decreased lactation in nursing mothers; the fetus: miscarriage, retarded fetal development, congenital defects such as club foot and Down's syndrome	shield or isolate operations using non-ionizing radiation; check sources regularly for production of X-rays
Temperature (Heat)	workers in bakeries, canneries, foundries, garment and textile factories, laundries, mines, smelters	male workers: decreased sperm count, atrophy of the testes; female workers: decreased fertility; the fetus: increased embryal death, low birth weight	provide adequate training and acclimatization, properly designed clothing, and frequent rest periods; enclose heat producing operations as much as possible; ventilate the work area

of 75 children exposed to X-rays while *in utero* found that 18 were retarded.[56] After the bombing of Hiroshima and Nagasaki, there was a notable increase of leukemia and other cancers in children exposed to the radiation before birth. When the fetus was exposed early in the pregnancy, there was an increased incidence of physical and mental retardation.[57] In 1958, Dr. Alice Stewart at Oxford, England reported that children X-rayed before birth had approximately a 50 per cent greater chance of dying from leukemia or other forms of cancer than children not X-rayed *in utero*.[58]

Closer to home, some investigators linked the 1979 accident at Three Mile Island, Harrisburg, Pennsylvania, U.S.A., to an increased rate of birth defects and deaths in animals near the plant. In addition, the incidence of miscarriage and congenital hypothyroidism appeared to have risen in the human population. Across the border in nearby Canadian areas, a rise in the infant death rate was reported.[59] Officials in the U.S. and the Canadian governments put forth a different interpretation of the statistics, claiming that none of the reported animal or human effects could be directly attributed to the Three Mile Island Nuclear Power Station. In particular, they assert that the widely dispersed radioactivity would have negligible significance for the health of Canadians.[60]

Some studies suggest that the gestational age of 6 to 15 weeks is the most sensitive to irradiation but caution that the effect of different dose levels on various stages of development is difficult to establish.[61] When the fetus was fully shielded while the mother was irradiated, no evidence of adverse effects on the fetus was found. This finding could have significance for the employment of women in irradiated environments, inferring that when the mother and the developing embryo are adequately shielded from irradiation, the risk for the pregnant worker may be no greater than that for a shielded male worker or shielded nonpregnant female worker.

The impact of radiation on the genetic material of the reproductive cells, the sperm and the ovum, has also been the focus of study. Experiments on mice populations revealed that the female ovary is more resistant to gene mutation than the male germ cells, and the theory has been corroborated in studies of humans and other primates.[62] Other research has supported the view that adverse reproductive outcome may result from the occupational exposure of the male partner to radiation. One report on Japanese radiological technicians noted that the male workers in this employment group have a higher sterility rate than that seen in the general population.[63] It is generally conceded, however, that firm conclusions about the effect of radiation on male and female fertility are difficult to establish in light of a scarcity of comprehensive epidemiological studies and corroborative research results.

In spite of the high level of public concern over the effect of ionizing radiation on the human population, no systematic examination of the reproductive history of exposed workers has been carried out in Canada. Much of the current data has been obtained from epidemiological studies of humans exposed during diagnostic, not occupational, irradiation. While providing useful information, such studies are not directly applicable to settings where workers may encounter lower levels over a prolonged, continuous period. For example, information, not only on personnel in hospital X-ray and nuclear medicine departments, but also on other workers (such as nurses, doctors, aides, and orderlies) who receive frequent low levels of exposure, would be a major contribution.

VDTs and Physical Hazards: Innocent or Guilty?

The need for studies on all physical hazards has become increasingly evident in Canada. Physical hazards, like chemical hazards, can arise from the creation of a highly industrialized, high-technology society. Several related incidents, widely publicized across the country, demonstrate the way that technology can be introduced with little thought for the potentially hazardous effect on the health of workers.

During July, 1980, newspaper stories revealed that four out of seven pregnant women who worked regularly on video display terminals at *The Toronto Star* gave birth to children with abnormalities.[64] Radiation was initially suggested as the culprit. Government and industry officials were quick to point out that prior to this incident, various models of terminals had been tested for radiation emission in both Canada and the U.S. In all cases, both ionizing and non-ionizing radiation were below recommended levels and in most cases, were not detectable using standard monitoring equipment. In addition, units at *The Toronto Star* and in other locations across Canada were checked after the incident was publicized and all reports indicated extremely low or non-measurable radiation levels. Nonetheless, similar stories of adverse reproductive outcomes in female VDT operators have surfaced at intervals over the succeeding years.[65]

Several groups continue to emphasize that the findings of health officials do not necessarily clear the machines of fault. On the issue of radiation, it has been suggested that although all VDTs possess a "fail-safe" mechanism which automatically shuts down the machine if the voltage reaches a certain level, damage or improper functioning of the mechanism combined with power surges could conceivably result in higher emission levels of both ionizing and non-ionizing radiation. Others feel that existing radiation standards are established arbitrarily. Besides the possibility of intermittent high levels of radiation, some

assert that the cumulative effect of even low levels of radiation exposure could possibly affect the sperm or ovum of a worker or could harm a developing fetus.

In addition, research on the effects of heat and noise, both of which emanate to some extent from the machines, especially when they are grouped together in large numbers, suggest that there is no room for complacency about the impact of prolonged continuous use of video display terminals. Even slight increases in heat and noise may place extra stress on the body, causing changes in blood circulation, in the flow of adrenalin through the body and in heart action. In female animals, slight increases in temperature are sufficient to affect the ovum, often leading to embryal death after fertilization.[66] In the male, whose sperm secreting organs are external to the body to keep them at a lower temperature, increases in temperature may inhibit sperm production.[67] In animals, noise has been linked with an increased incidence of stillbirths and neonatal deaths as well as multiple malformations of the fetus.[68] Similar findings have been observed in human studies involving females.[69] In males, noise has been linked with decreased fertility and sexual dysfunction.[70]

While it may seem ludicrous to associate so many hazards with one little machine, the possibility of any form of ill-health, reproductive or otherwise, needs to be fully explored. Many health problems — eyestrain, cataracts, neck and shoulder pain, tenosynovitis, stress and fatigue leading to anxiety and depression[71] — have already been associated with VDT use. At the time of the controversial *Toronto Star* incident, estimates suggested that about a quarter of a million — 250,000 — video display terminal devices were in use across the country, with at least 100,000 Canadians, mainly women, spending up to eight hours a day in front of them. More recent estimates place the number of affected workers as high as 700,000.[72] Airlines, banks, newspaper offices, insurance companies and government bureaucracies are among the list of organizations increasingly dependent on VDTs for information processing. As the use of these systems continues to grow at a rapid rate, greater efforts can and should be exerted to correct unhealthy work situations associated with their presence.

BIOLOGICAL HAZARDS

Biological hazards (see Table C)[73] are present in many forms and in many workplaces. They may exist as contagious human diseases, as animal diseases, as harmful dusts, or as fungi from vegetation. They are transmitted by cultures, vaccines, plants, animals and humans. They can be inhaled, ingested or absorbed and can attack many different parts of the human body. They can affect workers in laboratories, laundries, pet shops, abattoirs, hospitals, veterinary offices, schools, meat packing plants, dentists' offices, farms, grain elevators, textile factories, or animal training, breeding and care sites.

Of the biological agents found in workplaces, the infectious ones are most frequently linked with birth defects or other negative effects on the reproductive systems of animals and humans. These include bacterial agents causing brucellosis or tuberculosis, viral agents causing rubella, mumps, herpes or hepatitis, the protozoa agent causing syphilis, and the rickettsial agent leading to Q fever. When the offending agent attacks a worker, the body sets up certain defense mechanisms resulting in internal changes in body temperature, blood composition and other aspects of the body's biochemistry. In the pregnant female worker, these systemic effects may lead to fetal damage or death. Other damage to the fetus results when the infective agent travels through the mother's bloodstream and affects the fetus directly or when the infective agent is harboured in the birth canal and contacted by the newborn during the birth process.

Although little research has focused on the adverse effect of these agents on the male reproductive system, viral infections such as mumps have been linked to damaging and sometimes irreversible impairment of the male reproductive organs. In addition, some studies suggest that the sex cells may be infected before conception. For example, some literature indicates that viruses may infect the spermatozoa and be transferred to the ova during fertilization.[74] The wives/female partners of men working in occupations that expose them to infectious agents may be at risk, as well as women in direct contact with these hazards at the workplace.

Infectious Agents: Widespread But Underemphasized

Much of the literature on infectious diseases focuses on laboratory workers, in particular those who receive a wide exposure to all types of infective agents. For example, laboratory workers in the health services may be exposed daily to patient specimens that they must examine to diagnose the particular biological agent causing the patient's illness. While it is difficult to know exactly how many people in Canada may be at risk, figures from the 1971 census indicated that 8,085 women and 3,025 men were employed as medical laboratory technologists and technicians.[75] The consequences of biological hazards can be

particularly severe for affected workers and for their offspring. In 1969, a report on conditions for laboratory workers in the United States noted that the death rate from laboratory infections was 4.0 per cent, compared to only 2.7 per cent from motor vehicle accidents.[76] Yet, in Canada, while most laboratories have general guidelines or directives to cover the handling of infective agents, no government has issued specific regulations governing the handling of various types of pathogenic organisms.[77]

Other occupations employing large numbers of women may involve a great deal of exposure to infection. Laundry workers in hospitals and other locations may handle contaminated articles daily. Dental workers who handle equipment contaminated with human saliva are also at risk. Daycare workers, teachers, paediatric nurses, parents and other workers who have contact with young children may be infected. Women in retail stores, in receptionist jobs, in libraries are also vulnerable. These and many other occupations where women dominate have been under-researched. The need for epidemiological surveys is imperative.

In 1969, the nursing profession received some attention when E.V. Haldane and associates of Dalhousie University, Halifax published an exploratory study on 1,568 nurses engaged in professional work during pregnancy.[78] The group hypothesized that workers caring for infants who had been infected by viral agents *in utero* could then pass such infections on to their own developing fetuses. The study was a significant contribution to the scanty literature on this particular high-risk group of workers.

The authors found a higher incidence of congenital defects in the offspring of nurses who had either cared for infants with defects, both in the hospital and under home conditions, or had cared for premature infants at home. In particular, they found that nurses who had experienced an infectious illness during pregnancy, while caring for infants with congenital defects, reported double the incidence of congenital defects in their own offspring compared to nurses who had no illness and did not care for congenitally defective infants. The incidence was 18.2 per cent in the nurses who had reported infections compared to 8.4 per cent in the non-infected, non-nursing group.

Many of the reproductive problems associated with biological hazards are preventable. Hazard awareness programs that focus on protective measures and prevention can go a long way in reducing exposures. Proper instruction in the handling and disposal of contaminated articles is essential for those working in laundries, laboratories, pet shops, hospital wards, or abattoirs. Effective vaccines are also available for many workers who have no personal immunity to particular infections. Ongoing screening for animal and human carriers of disease could minimize the risk for vulnerable workers. Where

TABLE C

Some Biological Hazards That May Affect Reproductive Health

Hazard	Workers At Risk	Potential Reproductive Effect	Protective Measures
Brucellosis (Undulant fever)	animal breeders, farmers, health care workers, meat handlers, veterinarians	male and female workers: brucellae may lodge in reproductive organs, leading to local inflammations and infertility; the fetus: miscarriage, developmental defects	control infection in animals; use caution in handling diseased animals and their products as well as the urine and feces of infected humans
Chicken Pox (Varicella)	daycare workers, paediatric nurses, teachers, laboratory workers, parents	the fetus: prematurity, retardation, muscular, skeletal and heart defects, increased incidence of neonatal death	isolate infectious person and handle contaminated articles using aseptic techniques; pregnant women should avoid exposure
Cytomegalovirus	blood bank workers, health care workers, dental workers, laboratory workers	the fetus: infection leading to jaundice, enlarged spleen and liver, heart, eye and central nervous system damage in the newborn	use care in handling sputum, urine, semen, blood, and other secretions of the human body; pregnant women should avoid exposure
Hepatitis (Infectious and Serum)	blood unit workers, kidney dialysis technicians, laundry workers, laboratory workers, sterilization unit workers	the fetus: infection leading to miscarriage, prematurity, stillbirth and jaundice, enlarged spleen, increased death rate in newborns	isolate infectious individuals; label potentially infectious specimens visibly; use disposable needles syringes, lancets where possible; pregnant women should avoid exposure
Herpes Virus Hominus	health care workers, laboratory workers, research scientists	male and female workers: transmissible genital infections; the fetus: fetal death, miscarriage, liver and eye diseases, central nervous system damage	isolate infected persons or specimens; use caution in handling infected objects
Mumps (Infectious Parotitis)	childcare workers, hospital staff, laboratory workers, restaurant workers, teachers, parents	male and female workers: inflammation of testes and ovaries, leading to infertility or sterility; the fetus: miscarriages, stillbirths, developmental defects, hydrocephalus	isolate infectious persons, handle specimens with care; alert all workers potentially in contact; promote immunization

Rubella (German measles)	childcare workers, hospital personnel, laboratory staff, restaurant workers, teachers, parents	the fetus: placental infection may lead to severe congenital abnormalities including deafness, blindness, heart defects, mental retardation	promote immunization; isolate infected person; handle contaminated material with care; pregnant women must avoid exposure
Syphilis	blood unit workers, health care workers, laboratory workers	male and female worker: secondary lesions in organs of the body including reproductive organs, infertility or sterility; the fetus: embryal death, infecti on leading to liver and spleen enlargement, developmental defects	avoid contact with infected lesions; exercise caution in handling infected equipment
Tuberculosis	dairy farm workers, health care workers, laboratory workers, laundry workers	male and female workers: tubercular infection of the reproductive organs; the fetus: can be infected through blood transfer from the mother or by aspiration of amniotic fluid	promote immunization; test animals regularly; handle infected specimens with caution

necessary, workers who have been deemed high risk (including pregnant women) could be temporarily transferred without loss of pay or seniority to areas involving minimal risk of contact with infective agents.

Unfortunately, as a NIOSH study in the United States pointed out, even hospitals, whose express purpose is to promote better health, exhibit a noticeable lack of concern about any health and safety problems of their workers. In a nationwide survey of almost 3,700 U.S. hospitals, more than 30 per cent reported that they did not have a formal program of occupational health for their employees; fewer than 40 per cent required early reporting of pregnancy, and fewer than 15 per cent reassigned pregnant workers to safer conditions.[79] A similar study of Canadian hospitals could provide useful information for health administrators concerned with promoting health among their employees.

PSYCHOSOCIAL HAZARDS

Psychosocial hazards or stressors can be present in any job. They are complex, difficult to quantify, and can evoke a wide range of psychological, physiological, and/or behavioural responses in the affected worker. Any evaluation of potential psychosocial hazards must consider the nature of the job — wages and benefits, hours of work, amount of supervision, complexity of the presented tasks, physical work conditions — and the nature of the organization — degree of hierarchy, mechanisms for promotion, retraining, methods of decision making. To determine the full impact of occupational stressors on the worker's health, they must be interrelated with factors such as the general environment in which the individual functions, the influence of the home sphere, and the individual's particular vulnerability.[80]

The impact of psychosocial hazards on reproductive functioning in workers is seldom discussed. Studies of the influence of occupational stressors on human health have tended to focus on male workers and generally have examined the incidence of stomach ulcers, hypertension and alcoholism without considering any health aspects related to reproduction. Until recently, few studies on work sources of stress included women and relatively little was known about how conditions such as job satisfaction, work overload, lack of job control, or job responsibility affected the health of female workers. In particular, the effect of the "double workday" of many women, the way that their traditional family responsibilities add to the stress and fatigue of their paid labour outside the home, has received insufficient attention.

In 1979, a report done for the United States National Institute of Mental Health verified the longstanding assumption that for women,

as for men, occupational conditions have a decided psychological impact and that positive attitudes gained during paid employment spill over in their non-work lives.[81] Another study completed in 1979, the long-term Framingham Heart Study, looked at the relation between work stress and health for a large number of women of differing socio-economic backgrounds.[82] The researchers found that women with the highest risk of heart problems were those in clerical and sales occupations, married, with several children, working for nonsupportive bosses and feeling a definite lack of control over their lives.

As these and similar studies show, the relationship between work stressors and disease, injury or psychological dysfunction is complex but important. However, professionals in the field of occupational health, social work or mental health rarely consider the effects of work stress in treating conditions such as alcoholism, impotency, or marital breakdown, which may be its symptoms. The impact of psychosocial factors on the worker's ability to function, including reproductive activities, needs fuller appraisal by all members of the health community. Impotency in male workers as a result of job anxiety, increased use of alcohol and tranquilizers by male and female workers dissatisfied with their jobs, stress-related debilitating diseases such as coronary heart disease related to lack of job control, the effects of women's double workday — all may have direct or indirect consequences for the production of healthy offspring.

Robert Sass suggests in an article appropriately titled "Stress: The Tolerated Bedfellow", that the nature of work and technology is "perhaps the single most important variable affecting the environment, family life, recreation, leisure and the general health and safety of workers". Conditions such as shiftwork, which requires frequent alterations in the body's daily rhythms; piecework, which creates production pressures; assembly line work, which entails repetitive, routinized activity; and other situations where the worker must fit the job — instead of the converse — are detrimental to both the physiological and psychological condition of human beings. Robert Sass goes on to point out:

> *Workers do whatever possible to adapt to the demands of the workplace. This apparent adaptation shows up as* maladaption *outside work — in the form of marital problems, poor digestion, tiredness, strained relationships with children, alcoholism, drug abuse, etc. In fact, 85 percent of "breakdowns" occur first outside of work; only lastly does it spill back into work in the form of absenteeism, low productivity, insubordination and friction with fellow workers. Thus, the workplace is the first cause but the last effect in the chain of psycho-social illness.*[83]

Reproduction and the Stresses of Work

As noted earlier, the implications of work stressors for healthy reproductive functioning are little researched and little discussed. Some writers have suggested that stress caused by a variety of interpersonal tensions may affect the development of a fetus, leading to ill-health, neurological dysfunction, physical defect, slow development and behaviour disturbance in the child.[84] The stress for women of childbearing age who are faced with the choice of sterilization or job loss, motherhood or work can be enormous. These women are some of the victims of a society that requires workers to present special physical characteristics — in this case, sterility — in order to seek or retain certain jobs. Whatever decision these women "voluntarily" choose, the potential for detrimental effect on their health is enormous. They and their families, if any, must live with the consequences.

Workplace conditions such as shift work, which disrupts normal daily patterns of eating, sleeping and socializing may have physiological as well as psychological side effects. Disruption of the individual's circadian rhythms, the body's physiological response to light/dark changes in the surrounding environment, is inadequately understood but is believed to affect body temperature, heart rate, liver and kidney functions in shift workers.[85] In addition, shiftwork-induced change may delay or inhibit ovulation in women, leading to irregular menstrual cycles. The social and physical adjustments to shiftwork may cause both male and female workers to experience a loss of sex drive or may lead to impotency in men.[86] For some families where shiftwork is a regular condition of daily life, the way that work can affect non-work time and reproductive outcome may be as simple as this description by the wife of a Sudbury miner:

> *If they get off before us, sometimes they'll go drinking and won't get home until the bar closes. On other shifts, they're asleep all day and when we get home they've gone to work. We only get to see each other at breakfast.*[87]

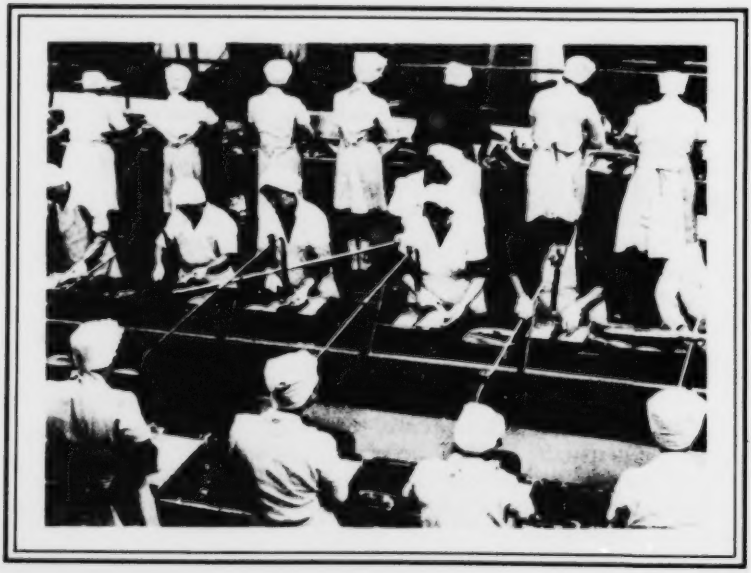
As noted earlier, some of the stress generated by workplace conditions may spill over and result in such problems as alcohol or drug abuse. Both are known to have serious ramifications for reproduction. Studies of alcohol abuse in pregnant women have led to the diagnosis of fetal alcohol syndrome in newborns. This condition manifests itself in affected infants through retardation, facial abnormalities and/or failure to thrive.[88] Male workers who drink excessively can also affect their offspring. One study by a University of Manitoba medical researcher, Dr. T.V.N. Persaud, revealed that in experiments with white rats, the male group that received alcohol equivalent to six or eight daily drinks produced sperm inferior in quantity and quality. When the male rats were mated, the litters were smaller, showed a statistically

significant incidence of prenatal death and spontaneous abortion, and surviving offspring were considerably smaller.[89] Other studies have also identified alcohol as a particular hazard affecting male reproductive abilities.[90] In addition, such drugs as analgesics, hallucinogenics and the tranquilizers so readily prescribed for women may impair reproductive functioning.[91] In pregnant women, the way drugs may affect the fetus depends on factors such as the stage of pregnancy, the amount taken in each dose and the frequency of doses. In males, drugs may suppress sperm production or cause the formation of sperm inferior in quality.

Psychosocial hazards are common to all workplaces and can be a major source of ill-health in a worker. When the human body is confronted daily, even hourly, by conditions of work that pull on all its reserves of energy, the strain on the body and the psyche can be enormous. Occupational stress is tolerated because of the prevalent notion that work activities can be neatly separated from non-work outcomes. Many people respond to another person's exhibition of non-coping behaviour by seeing it simply as an individual weakness unrelated to the overall organization of the workplace. The symptoms of stress are too often considered to result from the worker's personal characteristics or home environment. A truly concerned society will attempt to control the stressors rather than laying the blame on the back of individual workers. The structure of work and any negative impact on workers must be assessed and the work environment reorganized to fit the workers.

III

DISCRIMINATION IN THE NAME OF PROTECTION



As women have sought employment in a broader range of occupations, they have been confronted by employment policies that make them ineligible for certain work by virtue of their reproductive capacity. Enormous tension has developed between those seeking wider employment opportunities for women and those working within accepted health and safety guidelines for maternity protection.

The following chapter looks at the notion that workers should and can be selectively protected. It explores briefly the history of protective laws in Canada and documents some incidents of exclusion in Canada that have affected and continue to affect women's employment opportunities. It notes the limitations of focusing solely on fetal susceptibility to industrial workplace hazards while ignoring similar hazards in female-dominated occupations and while continuing to overlook the potentially adverse reproductive effects that are passed through

males. Finally, it raises some legal questions that will need answers if the issue is to be resolved.

Controlling Workers

Although women continue to be segregated into the lower paying, lower status positions, over the last two decades they have made some inroads into occupations which were formerly all-male in composition. As a 1964 Department of Labour publication noted, women were "thoroughly absent from production occupations in primary industries (mining, logging, fishing)" and were also absent from the "heavy industry" segment of manufacturing as well as from "transportation occupations proper".[92] By October, 1981, a labour force survey indicated that women were involved, albeit in small numbers in all of these categories — 3.3 per cent in logging, 10.9 per cent in mining, and 25.1 per cent overall in manufacturing, with 18.8 per cent in rubber production, 7.9 per cent in primary metal industries (including iron and steel mills and foundries), 21.6 per cent in petroleum and coal products, 24.6 per cent in chemicals and 10.9 per cent in transportation occupations.[93]

This movement by women into hitherto male occupational territory has generated conflict between proponents of increased employment opportunities for women and those concerned for the personal health of women and their potential offspring. With increasing frequency, protective policies aimed solely at female workers are being adopted in occupations involving known and potential reproductive hazards. The protection is usually in the form of outright exclusion or, at the very least, strong policy statements that are used to limit the hiring of women. The underlying premise is that women as the bearers of children are in need of greater protection.

As recent trends in employment policies indicate, the issue of protective policies is a broad one with the potential to affect the rights of many groups of workers. In some industries, employers use genetic screening to determine whether specific groups of workers have genes that could make them hypersusceptible to certain chemicals present in the workplace. As many critics point out, the genetic approach seeks to label people, often because of sexual, ethnic or social classifications, as unfit for particular jobs. Thus, the victims of industrial poisoning are blamed for having faulty genes and the unhealthy workplace conditions are permitted to continue. The controls are placed on the individual worker, not on the hazards that remain to affect other still vulnerable workers.

In jobs involving known reproductive hazards where company policies have dictated the exclusion or removal of women of childbearing capacity, the concern is equally misplaced. Female workers because of their reproductive function are seen as unsuited for specific jobs.

Arguments centre on female vulnerability instead of on the fact that the job is in all likelihood dangerous and unsuitable for any worker, male or female. The protective stance fosters the myth that reproductive hazards are exclusively a woman's issue. It ignores the right of all workers, male and female, to a healthy and safe working environment.

This focus on the reproductive susceptibility of women is not new. Since the late 19th century, protective legislation enacted in Canada has been aimed primarily at safeguarding the maternal and reproductive function of women workers. Ironically, in the past as in the present, only certain areas of work or certain occupations, mainly "male" in character, were covered by legislation restricting employment of female workers. Labour legislation that restricted night work and heavy lifting for women was never extended to female workers in areas like hospitals and restaurants.

Labour laws aimed specifically at women did not necessarily guarantee them good working conditions. By denying women employment in specific occupations, such legislation often simply forced them to find work in equally unhealthy but uncontrolled workplaces such as sweatshops and domestic situations. While many of the attempts to enact protective legislation for female workers were well- intentioned and did effect changes in working conditions that were beneficial for all workers, male as well as female, the resulting restriction on the hours and places of work for women made them less competitive and compounded their low status and low economic position.

Protective Policies: The Past

A brief look at the historical basis for the protective policies may be useful. Reform-oriented groups, many of them comprised largely of middle class, urban women, were increasingly active over the last quarter of the 19th century, and one of their prime targets was the woman who worked outside the home. The dismal conditions faced by working women were an obvious contradiction to the Victorian view that woman was "angel of the home and the hearth" and that her prime function was to bear children and to uphold the moral fibre of society.

The National Council of Women, a reform-oriented organization formed in 1893, assumed early in its development a role as guardian of the unprotected female worker. Like some other groups of female reformers, they often argued for both political equality for women and special protection for working women without acknowledging the contradictions in their positions. Besides their stress on separate lavatories and female inspectors, they emphasized the importance of seats for female employees, not specifically to reduce the fatigue and stress of their work, but because extended periods of standing were considered to be harmful to the reproductive organs.[94]

In 1901, when the 1884 Ontario Factory and Shops Act was expanded to limit the hours of labour for females and children and to ban employment for children under 14 years and young girls or women whose health might be permanently injured, the rationale for protection was argued as follows:

> *When I tell you that today we have in this province, women working in the foundries, machine shops, and breweries, some of the weaker sex, and not a few of their champions will be surprised. I do not mention this as meaning to say that labour for women and children is degrading, but rather to show ample reason why they should be protected ... the effect of propagation by the present race and the degeneration of future generations.*[95]

Canadian unions along with the middle class reform organizations and government legislators advocated protective legislation for women. In 1898, the Trades and Labour Congress of Canada called for the exclusion of women from "all branches of industrial life, such as mines, work-shops, factories".[96] Like the other groups, they saw women's primary role as a domestic one and viewed working women as both a threat to male participation in the labour force and as a segment of society that needed strong protection from exploitation. This ambivalence was characteristic of many nineteenth century reformers and legislators. Unions, however, often saw protective legislation as one reform element that might lead to the alleviation of unhealthy and arduous working conditions for both women and men.

At the international level, the International Labour Organization (ILO) has over the years adopted several Conventions promoting protective laws for women. To date in Canada, the federal government has not ratified any of the "protective" Conventions of the ILO that apply specifically to women workers. In general, Canada takes the view that measures to ensure health in the workplace should be available equally to men and women. However, in practice, protection for maternity reasons may be deemed necessary. Thus, following the spirit of the ILO Convention on benzene, the federal Canada Dangerous Substances Regulations give employers the right to terminate employment for pregnant women when a medical practitioner has determined that the employee's health might be endangered.[97] Estimates of how often this authority is applied are difficult to obtain. At the provincial level, female workers were, in the recent past, prohibited from working at such jobs as mining; were limited in the hours they could work; or were not permitted to lift certain weights. Most governments have now repealed laws that specifically restrict the employment of women.

Although laws prohibiting the employment of women appear to be in the past, the theme of protection for women workers has not

disappeared. With increasing frequency, individual industries across Canada and the United States are adopting selective hiring policies which purport to protect the offspring of female workers from hazards inherent in certain workplaces. Greater than the need to protect the personal health of all workers is the perceived need to protect the childbearing potential of women, their reproductive function. The impact of such hazards on the male reproductive function and, through the male, on the offspring is not considered.

History Repeats Itself: Current Protective Policies Exclude Women

The following section documents incidents of exclusionary policies in North America, particularly Canada, and discusses their negative impact on all workers. This particular selection of incidents is not intended to suggest that the problem is limited only to those industries and workplaces cited here. It merely reflects the fact that these cases have already been documented to some extent in public reports and they are used here to demonstrate that the problem is widespread.

In December, 1975, General Motors in Oshawa made headlines in Canada and the United States. Norma James was one of several female workers in a lead storage battery division who was asked to show proof

of sterility or to submit to a transfer to a lead-free area of the factory. The company based their decision on medical evidence suggesting that a fetus could be harmed by exposure to lead. They ignored other findings that suggest that exposure of male workers to lead can result in the production of abnormal sperm, low sperm counts, decreased sex drive — all factors that adversely affect reproduction. Norma James wanted to keep her 11 pm to 7 am shift job to ensure that she could be at home with her children during the daytime, so she had a tubal ligation. As she commented afterward, "If you want your job badly enough you'll do anything". Although the women took their case to the Ontario Human Rights Commission, the issue was not resolved by the Commission's ruling.[98]

On a quieter note, in 1976, INCO Ltd. in Sudbury, Ontario decided to exclude women of childbearing potential from certain sections of their nickel and silver refineries because of concern for the health of potential fetuses. In the nickel refinery, the perceived problem was a medication routinely administered as an antidote for exposure to nickel carbonyl gas. The substance, sodium diethyldithiocarbamate, or dithiocarb for short, was used approximately once per month but had not yet been tested for its effect on a fetus. In the silver refinery, the use of two metals, selenium and tellurium, was cited as the reason for excluding women because of evidence linking the metals with congenital abnormalities in animals.[99]

Meanwhile, growing numbers of women in the United States openly admitted that they had undergone sterilization procedures in the belief that it would prevent job loss. When the women went public, labour unions, women's organizations, and other groups dismayed over the negative ramifications for women banded together as the Coalition for the Reproductive Rights of Workers (CRROW). As CRROW has stated, they seek an end to the unacceptable choice between a job and the right to reproduce, in particular, to corporate policies focusing on altering the worker rather than the workplace. One of the Coalition's first tasks was to gather information to fight the increasing tendency to exclude female workers. CRROW estimates that if employer policies excluding women "for their protection" go unchallenged, two out of three women applicants will be barred from a very large segment of the workforce.[100] They identified a number of employers who had adopted selective policies that prohibited the employment of women in certain areas of their industries and documented the facts for the campaign against such discrimination.

Some of the U.S.-based companies that adopted exclusionary policies were documented as follows:[101]

Allied Chemical Corporation, Specialty Chemicals Division, laid off five women on the grounds that Fluorocarbon-22 might interfere with future

pregnancies. The result was that one woman was sterilized, two others had tubal ligations while two were laid off. The company's announcement apparently indicated that the hazard existed for men as well but no action was taken against male workers.

B.F. Goodrich excluded an unspecified number of women of childbearing capacity from jobs involving exposure to vinyl chloride. It was willing to hire only women with medical sterilizations for such positions.

American Cyanamid excluded six fertile women from jobs involving exposure to two teratogens, diomox and methobrexate and laid off women unable to bid on other jobs. A different branch of this company excluded eight women from lead exposure jobs; five were sterilized.

Avtex Fibers, Inc. excluded fertile women from jobs involving a high risk of carbon disulfide exposure.

The implications for Canadian women are serious. Many U.S. companies operate branch plants in Canada and the policies of the parent organization are applied here. In addition, several Canadian companies have followed the U.S. lead and reduced employment possibilities for women of childbearing potential.

In April, 1979, *Maclean's* reported on a decision by the Hudson Bay Mining and Smelting Company copper plant in Flin Flon, Manitoba.[102] Five female employees, aged 19 to 28 years, were advised to change jobs within the company, even though it meant getting less pay. The company stated that it would refuse employment inside the smelter to women of childbearing age unless they could prove sterilization. Debbie Borley, an employee for four years, was caught in the vicious process. At age 23, married with no children, she was unwilling to seek sterilization but worried that she could suffer from lead poisoning if she stayed at her particular job. On the other hand, the job the company offered as an alternative paid almost a dollar less per hour. As a puncher responsible for keeping the air holes in the copper converter clear, she earned $7.10 per hour. The job offered by the company was for outdoor pick and shovel work at $6.15 an hour.

In February, 1980, the issue of exclusionary or selective hiring policies made headlines again, this time in Alberta.[103] Diamond Shamrock Alberta Gas Limited, which began production of polyvinyl chloride at Fort Saskatchewan in early December of 1979, confirmed that it was company policy not to hire women capable of bearing children. At this time, the Company's general manager was quoted as saying that "there is a lot of conflict of data and we just decided that we'd err on the side of safety". Meanwhile a concerned scientist pointed out that if women are excluded from working in an area on the basis of possible risks, you're discriminating against males by hiring them.

Another example of exclusion was described by Marianne Langton in an article focusing on the issue of reproductive hazards. She noted that at Ontario Hydro, women of childbearing capacity could not work in the nuclear plants as operators, mechanical maintenance personnel, and control technicians and that Hydro itself estimated that as many as 2,000 jobs were unattainable by women. The company asserted that the basis for its policy was the Atomic Energy Control Board regulations, which specified permissible radiation exposure limits for workers. As noted in the discussion on ionizing radiation in the preceding chapter, AECB regulations currently limit the abdominal dose for women of reproductive capacity to 0.2 rem per 2 weeks. For male workers, the only restriction is that they should not receive more than 3 rems in three months. However, a recent ruling by the Canadian Human Rights Commission has resulted in an announcement by the AECB that it intends to change its regulations while Ontario Hydro has agreed "to modify its procedures and its hiring policy as soon as the AECB changes are official". The changes proposed by AECB would place the same dose limits on male and female workers regardless of reproductive capacity but would retain current lower dose rates for pregnant women.[104]

The Focus on the Fetus: A Case of Limited Vision?

As all these cases of exclusionary policies and practices illustrate, the tendency is to give major emphasis to one narrow aspect of the health of female workers. Exclusionary or selective hiring policies in workplaces across Canada have emanated from a preoccupation with fetal susceptibility to workplace hazards. Researchers, employers and legislators have focused on the incidence of birth defects, spontaneous abortions and stillbirths as prime measures of the effect of workplace hazards and have attributed such effects solely to transmission by the mother, ignoring the role of the father in reproductive outcome.

Ironically, while the focus on the fetus has led employers and others to insist that all fertile women between 15 years and 45 years must be considered high risk workers with a great potential for pregnancy, the majority of women continue to work in jobs where they are exposed daily to reproductive hazards. Thus, the current assertions that women are excluded from certain industrial jobs for the good of their health and their offspring are proven false if one looks at even a few of the places where women are expected to find employment.

Consider, for example, health care institutions: women make up more than 75 per cent of the workers in medicine and health occupations and may be exposed daily to potent hazards such as anaesthetic gases, radiation, ethylene oxide, viruses, solvents and other toxic substances. As nurses, doctors, physiotherapists, cleaners or laundry

staff, they may encounter physical injury and mental stresses in their work. Any of these hazards can affect not only their general health, but also their ability to produce healthy offspring. Yet no employer has to date adopted a hiring policy that excludes women from working in hospitals or other health centres.

As office workers, women are exposed to potential reproductive hazards ranging from the constant noise in typing pool rooms to fumes from correcting fluids to the stress of working for low pay for demanding, inconsiderate bosses. Although trinitrofluorenone (TNF), a photosensitive material used in photocopying, has been shown to cause cancer and to change genetic material, few employers have rushed to exclude female employees from using copy machines.[105]

In the laundry and drycleaning business, where more than 60 per cent of the employees are women, the pay is low and the working conditions are hot, noisy, physically tiring and dangerous. Solvents such as benzene, carbon disulfide, methyl chloroform and other substances known for their potential to damage developing fetuses may be present. In addition, many of the incoming clothing articles may be contaminated with chemicals, dust, or disease. Women have not, however, been told to seek work elsewhere.

Employers and legislators who use evidence of fetal damage to exclude fertile women from industrial jobs seldom explore the other side of reproduction. The idea that fertile male workers between the ages of 15 and 65 have the potential to impregnate and adversely affect the outcome of the pregnancy is ignored. Men continue to work in environments that are dangerous to both their general health and their reproductive functioning.

Certain substances or agents may render a male worker sterile, cause cancer of the reproductive organs, lead to sexual impotence, damage the sperm, or contaminate the seminal fluid in such a way that any resulting offspring will be adversely affected. Although research findings make it clear that any consideration of susceptibility and any protective policies should include all fertile male as well as female workers, employers and legislators continue to ignore the facts.

Legal Questions and Reproductive Rights

The legal questions revolving around the increased incidence of selective hiring policies, particularly questions concerning liability for a damaged fetus and the issue of sex discrimination, crop up repeatedly in any discussions on the subject. At the present time, assessments of the possible legal positions are based primarily on speculation. Lawyers have not yet explored all the legal principles that could be involved. Court rulings have not clearly established the

directions that fetal injury or discrimination cases might take.

Many employers who exclude women from their workplaces claim a concern for the health of the female worker. When the claim is explored further, it becomes clear that most are worried about the possibility of legal suit from a child damaged by workplace exposure as a fetus. Because an offspring is not an employee as defined by Workers' Compensation Acts, it is unlikely that this route could be used to claim compensation for disabilities acquired as a result of unhealthy workplace conditions. However, a damaged offspring could conceivably seek to prove negligence on the part of its mother's employer, perhaps aiming for a large settlement under laws which apply to personal injury. It has been suggested that in cases where a fetus is stillborn or where a child dies as a result of workplace conditions that caused damage *in utero*, some provincial laws may permit action against an employer by a parent, grandparent, brother or sister.[106]

For female workers, the issue of sex discrimination is central to any discussion of exclusionary policies and reproductive health. Rights for working women in Canada have always been precarious. As recently as 1929, women in Canada were not considered to be "persons" within the context of the British North America Act.[107] When women tried to assert their right to hold public office, to work in certain occupations, to have the same rights as males, they were rebuffed on the basis of their anatomy. Because of their ability to bear children, women were regarded as incapable of performing certain roles in society. In the current federal and provincial anti-discrimination laws, discrimination on the basis of pregnancy or reproductive physiology is not specifically forbidden.[108]

Regulations viewed as discriminatory need to be challenged, and several complaints involving reproductive hazards are currently before the Canadian Human Rights Commission. While most instances of discrimination have applied to female workers, such policies have been used and may increasingly be used against men. One such incident was reported in a labour federation newsletter. In an unusual move, a drug manufacturing company in Britain, on discovering that its male workers were developing breasts, was given permission by the equal employment opportunity office to exclude men from the workplace.[109]

Other questions, besides those relating to an employer's responsibility for maternal exposure, arise from a discussion of legal issues surrounding reproductive hazards.

- *What is the possibility of legal action from an offspring damaged by paternal exposure to workplace hazards?*

- *Could male and female workers who exhibit impaired sexual reproductive functioning as a result of workplace exposure push for compensation?*

- *What liability would a parent have if she/he chose to stay in a potentially hazardous work situation that affected a fetus?*

- *How would the cause of a fetal injury be established?*

If and when these and other unknowns are explored in the Canadian legal system, the situation surrounding protective policies might become clearer for both workers and employers.

IV

WHY DOES WORKER HEALTH CONTINUE TO BE IN JEOPARDY?

The existence of reproductive hazards in numerous workplaces across the country raises many issues that are of vital concern, not only to the exposed workers, but also to the rest of the population. The fact that these hazards continue to place workers in jeopardy contradicts the acknowledged right of Canadians to a healthy and safe working environment.[110] Instead of promoting the physical, mental and social well-being of workers, conditions in many workplaces across this country actually create disease and infirmity in previously healthy individuals and their offspring.

The health of workers should be of primary concern when regulating safe Canadian workplaces. However, this is not always the case: the following chapter examines some of the factors that influence efforts to create a healthy workplace. It attempts to provide some background to the question of why the reproductive health of Canadian workers continues to be in jeopardy. The issue of past and present protective

legislation and policies, particularly with reference to women workers, was explored in the previous chapter. In this section, some of the economic concerns that affect workplace health and safety, political issues such as jurisdictional responsibility and worker rights, and scientific questions associated with research methodologies and data collection will be discussed. In addition, emphasis is placed on the connection between occupational health and the broader community or environmental health issues.

This report does not pretend to cover all the issues surrounding the reproductive health of workers or to provide an exhaustive discussion of each issue, but it does try to alert readers to the diversity of factors that can influence any decision on health and safety. Simply identifying the problems does not solve them but does provide background knowledge essential for change. By understanding where the resistance to change may be strongest and some reasons for this, workers and other concerned Canadians can direct their energies at these areas.

THE QUESTION OF COST

When reproductive hazards are identified and it becomes necessary to reconsider workplace conditions, economic factors play a major role. Although employers in Canada will give careful and generous consideration to many expenses associated with their particular enterprise, health and safety costs are generally designated a low priority. Protecting any aspect of the health of workers often takes money that, from a business perspective, may yield few profitable returns. When the cost of protecting human health does arise, the common framework for analysis is one called cost/benefit or risk/benefit analysis, where the perceived costs of a preventive program may be weighed against the perceived benefits to society.[111] The following discussion looks at some of the issues associated with determining the costs/benefits of attempts to prevent worker exposure to reproductive hazards.

Worker Health Versus Cost to Employers

The major problem in most situations involving exposure to reproductive hazards is the difficulty of measuring absolute costs. For example, how does one measure the cost of workplace induced sexual impairment in a male worker? Can we place a price on impotency or infertility leading perhaps to great mental anguish, to marital breakdown or to other deleterious side effects? Is there a way of measuring the psychological, medical and other costs of occupationally linked cancer in the reproductive organs of a female worker? What is the overall cost to society for the long-term care of a child born with birth defects? Can human life and human health be valued in monetary terms?

Although many people might balk at the suggestion of using human life and human health to barter for better working conditions, they are in reality the focal points of health and safety-oriented cost/benefit analyses. For example, the risk of ill-health in workers may be debated against the expense of pretesting chemicals. One estimate suggests that using animals to test one chemical substance may take from $100,000 to $300,000. In assessing the risk of chemical and other hazards, epidemiological studies involving exposed workers may be initiated. However, such studies may require several years to complete and have been associated with price tags of up to one million dollars per project.[112] One solution may be to employ short-term laboratory tests with microbes to give a quick and inexpensive indication of which high-risk compounds need additional, more comprehensive testing.

Manufacturers are often less than eager to assume either the responsibility or the costs for proving that new chemical compounds are safe for all aspects of human health, and governments may have neither the facilities nor the money to do the testing. Problems have arisen when private laboratories are contracted to supplement the information on manufacturer's products. In a recently publicized case involving Industrial BioTest Laboratories of Illinois and numerous chemical manufacturers, heavy reliance by both the U.S. and the Canadian governments on research improperly carried out by this particular testing laboratory led to the licensing of chemical products later linked with birth defects, nerve damage, cancer and metabolic problems.[113] Although Canadian government specialists and facilities are currently too few in number to undertake the enormous task of prescreening products before their introduction into the workplace, more attention to premarketing procedures seems to be essential if workers and consumers are to be protected.

Other health and safety-oriented measures, while reducing risks for workers, may also add to an employer's expenses. Technological innovation in the design of machines, processes and techniques can go a long way in reducing worker exposure to hazardous substances or work processes. At the same time, however, engineering designs and other efforts to make workplaces safer could contribute to higher costs and lower profits. Employers who voluntarily implement workplace safety measures may find that they have lost an economically competitive position to some other employer who hasn't installed the expensive equipment or done the extensive workplace renovation needed to ensure worker health.

While there are no known Canadian studies evaluating the particular employer costs incurred by more stringent health and safety standards, recent assessments in the U.S. suggest that the monetary outlay may be lower and the benefits higher than has been assumed. The Council on Economic Priorities, a U.S. public interest group, recently

used OSHA's inspection records to determine that, at a cost of only $140 per worker, improved regulations have accounted for a 23 per cent drop in illness and injury rates among chemical workers.[114] Observers of the new standards imposed on U.S. textile firms have noted that the unwelcome prod toward modernization of machinery and processes may actually benefit the industry by making it more competitive with foreign markets.[115]

Because health and safety standards vary from one part of Canada to another, employers, particularly those involved in manufacturing, may actually shop around for the best deal in terms of less stringent and therefore less expensive workplace legislation. Companies, when pushed to comply with health and safety improvements, may assert that they cannot afford the cost. Workers, when faced with the threat of plant closure, may decide that the risk of ill-health is a lesser evil than the possibility of chronic unemployment or a move to a different geographic area in search of new work. In addition, workers are often faced with the realization that the introduction of new technology to reduce hazards may result in fewer jobs. The end result can be that workers continue to endure unhealthy and unsafe conditions in order to stay employed. The cost in terms of human health may be enormous.

Is It Good Economics to Exclude Women?

One cost seldom analyzed in economic discussions of health and safety policies is the one surrounding discriminatory employment policies. What are the costs to individual workers and to society when certain groups are excluded from specific jobs and related income levels? In the case of reproductive hazards, what are the costs of excluding all fertile women from workplaces potentially hazardous to developing fetuses?

Although there are no accurate figures on the number of women who might be affected by exclusionary policies, the following statistics give a general idea of the scope of the issue. Between 1969 and 1979, the participation rate of Canadian women increased from 38.0 per cent to 48.9 per cent, with the result that women are currently almost 40 per cent of the total labour force. By 1979, 63 per cent or almost 2 out of 3 working women were between 20 and 44 years of age, that period commonly designated as the childbearing years.[116]

When women are denied employment and a fair wage, the costs to society may be substantial. Like their male counterparts, women need employment in order to be self-supporting or to maintain the family income above poverty level. Consider these statistics: 30 per cent of women in the labour force are single, 10 per cent are widowed or divorced or separated, and over a quarter have children under six and

husbands with incomes of less than $12,000. Add to this the fact that more than 50 per cent of female-headed households (single-parent families headed by women) earn less than $11,000 per year and the economic prognosis for female workers is gloomy enough without adding exclusionary policies to the labour scene.[117]

While a number of explanations are commonly given to account for the continued segregation of women into jobs offering low pay and few opportunities for advancement, one can perhaps be forgiven for wondering how much the low wages paid to women (62 cents to every man's dollar) have helped corporate profit margins.[118] On the issue of exclusionary policies, keeping fertile women out of certain industries not only ensures that their employment options continue to be limited, but also avoids the need for costly changes to the work environment.

The point is not simply that women are excluded from jobs offering a decent wage and that they continue to work in low paying and often unhealthy jobs as office workers, laundry workers, textile and garment workers and health care workers. What needs to be recognized is that women are already a significant part of the paid labour force and health and safety research and standards should reflect this fact. Workplace health and safety standards should protect all workers, men and women, from reproductive hazards as well as from other factors that could affect their general health. Ignoring these concerns now could conceivably lead to enormous social costs in the future.

The Limitations of Workers' Compensation

While employers may be reluctant to pay the direct cost of preventing ill-health in workers, under current Workers' Compensation Acts and Ordinances some workers are entitled to compensation for disability acquired as a result of work and leading to impaired earning capacity.[119] Each of the ten provincial Acts and the two territorial Ordinances has different conditions and different interpretations for determining which work-acquired diseases are compensable. The usual procedure is to establish that a specific disease is a risk peculiar to a certain occupation or occupations and that its incidence in that occupation is substantially greater than its incidence in the general population.

In relation to reproductive health hazards, the present system of Workers' Compensation has little applicability. Pain and suffering are not usually compensable. Damage to the reproductive system resulting in impotency, infertility or fetal damage is unlikely to be covered as these conditions rarely impair a worker's earning capacity. While many of the effects may be crippling for the worker in a psychological or social sense, few would visibly disable the worker. To justify compensation, the worker must be not only unable to continue at the

present job, but also unable to earn elsewhere. In addition, insured workers lose the right to sue their employer for impairment sustained in the course of employment. The right to compensation benefits substitutes for the right to sue for damages. However, in most jurisdictions if a third party is liable, the worker or dependents may sue that party.

In spite of the fact that many Canadian workers are not included in workers' compensation figures (as much as 15 per cent of the Canadian labour force may be ineligible[120]) and despite the fact that reproductive hazards are not considered, the cost of occupational accidents and disease is enormous. In 1978, benefit payments amounted to $967 million, a fourfold increase from 1969. When indirect work injury costs such as decreased efficiency, lost supervisory time, material damage, and retraining are counted along with direct cost (excluding pension paid out), the cost was close to $3.5 billion for the year.[121]

Although the compensation legislation asserts that all costs are to be borne by the employer, most tend to regard the compensation as a direct cost of production to be passed along to the consumer as a proportion of the price of the goods and services purchased. Thus, in the final analysis, society at large will bear the costs of work- induced injury and disability as well as the cost of workers not covered by compensation, of women excluded from lucrative employment, of chronic health effects in workers, of impaired reproductive ability and of unhealthy offspring.

In a society that demands acceptable financial return on investments, workplace health and safety measures are low priorities. Because the major costs of work-induced illnesses have traditionally been carried by the victims themselves and by other taxpayers, employers have had little economic incentive to prevent the diseases their workplaces create. Corporate profits and high production levels continue to be more important than human health. It is time for a new look at the issue of health and safety costs and at the perversity of a system that makes well people sick while excluding others "for the good of their health".

WORKPLACE POLITICS AND REPRODUCTIVE HEALTH

The political issues central to any discussion of reproductive health cover a wide range and are as diverse as the views of the three major groups involved. To date, there appears to be little consensus among labour, management and government officials on how health and safety problems in the workplace should be tackled. Management usually represents business interests, which insist on acceptable profit levels; labour, as well as acting to ensure the health of workers, must rely on friendly interactions with business to ensure employment;

government must try to meet the needs of both groups while trying to gauge the national feeling. The following discussion looks primarily at two major concerns — the lack of a national focus in health and safety and the issue of worker rights.

The Jurisdictional Jungle

Any attempts to deal with health and safety issues are complicated by the multiplicity of legislative and policy directions at the governmental level. The division of jurisdictions among federal, provincial and territorial governments; the sharing of health and safety responsibilities among departments; the vast number of laws and regulations applying to different workplaces across the country; all these factors contribute to the confusion surrounding health and safety issues. In 1976, Labour Canada estimated that the existing legislation pertinent to occupational health and safety consisted of "more than 150 provincial and federal laws and 400 sets of regulations administered by more than 70 different departments and agencies".[122] Although the situation has been rectified to a certain extent since then, the enormous problem of determining "who is responsible for what" still slows down the process of ensuring worker health.

Across the country, there exists no clearcut approach to health and safety. Among the federal, provincial and territorial jurisdictions, there are varying views and often several different departments dealing with the issues. Many governments opt for the model in which employers and government work closely together to establish guidelines and regulations based on the "best practicable means". Some seem to be moving toward an approach that places emphasis on specificity in regulations and imposition of penalties for noncompliance.

In the case of reproductive hazards, determining which jurisdiction a job is covered by is only one of the problems a worker will encounter. Tracking down the department with the primary administrative and legislative responsibility and isolating the applicable legislation is another major step. Fortunately, in some provinces (Alberta, Saskatchewan, Quebec, and New Brunswick are some examples), major health and safety enforcement and administrative responsibilities are collected into one operating department. Other problems relate to the fact that it may be difficult to obtain guidelines that determine not only the permitted level of exposure for a worker but also whether fertile women are to be treated differently. If this occurs, it becomes very hard for a concerned individual or group to evaluate a particular situation.

The Rights of Workers

Generally, the moral, legal and financial responsibility of employers

to provide a healthy and safe workplace is a concept recognized across Canada. However, occupational health and safety at work is clearly an issue that no worker can afford to leave to the sole discretion of others. While ideally no worker should be forced to bargain for the right to personal health or the right to a safe workplace, historically, most of the gains made in health and safety in Canada have come about as a result of prolonged and intense labour union lobbying and negotiation. The first Canadian workers' compensation law enacted in Ontario in 1915, the more recent Beaudry investigation into the Quebec asbestos industry, and the Ham Commission on the health and safety of miners are but a few of the actions initiated after years of organized pressure by workers.

Until recently, employees had few options for ensuring any aspect of health and safety at work. Worker participation was simply not a reality. They were seldom consulted in any decisions made by government or management to change workplace conditions. When they were involved in government consultation, they were required to compete with their employers in an often unbalanced contest. Joan Brown, in an analysis of the industrial bargaining situation, put it this way:

> *... where the views of industry and labour are in conflict, the dice are often loaded against labour. Industry is able to bear the cost of the preparation of detailed briefs, it can afford to hire legal, medical and other expertise, and has access to sources of information denied to workers. Many labour organizations have few staff, limited funds, and because of government's failure to collect and publish adequate data on occupational health and safety, may have a poor information base.*[123]

However, across the country, research and educational activity on the part of worker organizations, legislative efforts by governments, and cooperative endeavours by employers have increasingly resulted in a more worker-oriented approach to health and safety. Most provincial governments (starting with Saskatchewan and with the exception of Nova Scotia, Prince Edward Island and Alberta) have now adopted some form of mandatory committee system to involve workers in on-site programs. Such committees generally play only an advisory role, with no legal authority to penalize employers for infringements of health and safety regulations. The federal government currently leaves the issue of committees to the discretion of the Minister of Labour, but the proposed changes to the Labour Code in 1982 are expected to make them mandatory.

In addition to the committees, seven of the provinces (Alberta, British Columbia, Manitoba, Newfoundland, Ontario, Quebec, Saskatchewan) as well as the federal government now provide some

distinct form of statutory protection to individual workers who refuse hazardous work. Nova Scotia and New Brunswick have some very limited provisions. The strength of the legislation and its effectiveness varies across the country. In some provinces, the right may be exercised if the work is likely to endanger any worker; in others, the danger must be unusual or imminent. The process tends to place the burden of proof on the worker; it can be expensive and protracted; and it may result in dismissal of the worker. In all provinces, the non-unionized worker is less likely to exercise the right and since over 65 per cent of Canadian workers are not members of unions, this is a serious issue.[124]

While the problems of identifying the general health concerns associated with many workplaces are great, trying to identify reproductive hazards is an enormous task. Most workers do not have access to full information about potential workplace hazards. Many reproductive problems are difficult to link directly to the workplace. Workers may be reluctant to discuss any personal effects related to sexual and reproductive ability. Medical personnel may be too unfamiliar with workplaces and types of exposure to be able to suggest cause and effect relationships.

If this is the case, consider just a few of the difficulties of exercising the right to refuse work because of reproductive hazards. In one incident reported in Toronto, Ontario, a woman decided to sue her employer after she contacted German measles as a result of exposure at her office. Knowing that she was pregnant, the woman had requested time off work to avoid contact with a co-worker who was thought to be infected. Although the woman was eventually given leave, the initial request was refused. The woman broke out in measles shortly after leave was finally granted and was advised to have an abortion. This instance, besides emphasizing the difficulties inherent in refusing to work in a hazardous area, points out the need to look more attentively at ways to identify and control biological and other reproductive hazards.[125]

Until more attention is directed to these specific health problems, until more funds are allocated to a study of the multiple effects on the male as well as the female worker's reproductive cycle and functions, until the personal reports of workers are taken seriously by government and management, the right to refuse work for reasons linked to reproductive ill-health will not be treated seriously and exercised when needed. Workers who stand to lose the most as a result of workplace exposure should have clearly defined rights and must have the necessary links with fact gathering, medical monitoring and enforcement services to ensure that these rights are exercised.

SCIENTIFIC SCENARIOS

Scientific research into rapid and accurate methods for detecting potentially damaging substances or processes is essential to any attempt to prevent reproductive dysfunction. At the present time, data on the impact of work on health are collected in several ways, including observations of human populations, studies on animals, insects and plants, and experiments using simple organisms such as bacteria. As researchers are quick to point out, any of these methods of data collection can present problems with the interpretation and use of the findings.[126]

The Gap Between Science and the Workplace

Most researchers are opposed to the uncritical application of results obtained from laboratory experiments, arguing that there are many uncertainties in extrapolating from laboratory test models to the worker population. Experiments, they say, can show us when and how certain agents or conditions adversely affect the development of sex cells or the growth of a fetus, but they cannot be equated with the human situation. Different species of animals, insects and plants reveal varying degrees of susceptibility at different stages of the reproductive cycle. All experimental results, they say, must be interpreted carefully by knowledgeable and rational people.

Although these suggestions are quite valid, they also indicate a rather narrowminded approach to the process of determining the human implications of exposure. They offer a "trust us, we're the experts" attitude, which discourages much-needed participation and discussion from other persons who are interested in workplace health. Because scientists tend to be cautious about offering firm statements on causal relationships and often hesitate to suggest definite directions for action, the end result can be a stalemate, with employers continuing to postpone action and workers continuing to work in contaminated workplaces.

The biggest problem may be, not a lack of applicable scientific knowledge, but rather a credibility gap between academic or scientific research findings and worker-generated experience and observation. Bruce Doern, in a study of the regulatory and jurisdictional issues surrounding health and safety in Canada, points out that:

> *The history of occupational and environmental health hazards bears witness to the constant presence of two kinds of experience about evidence. One kind is found in the more rarified level of scientific journals and symposia. A second is found in union halls and work sites or in workmen's compensation cases. The first level of experience tends to view the second as being merely a series of "cases" and*

thus not causal evidence. The second level tends to perceive the first as remote, foreign and largely subservient to interests other than its own.[127]

Workers have good reason to believe that occupational health research may be influenced by forces other than those considered to be within the legitimate realm of science. Documented cases of the manipulation of data by industry-financed experts are showing up at an alarming rate.[128] In the 1930s, women who applied a radium-based paint to watch dials were initially told that their ill-health and crumbling bones were linked to syphilis, bacterial infections and other causes far removed from the real culprit, the radium. In the 1960s, pregnant women who took Thalidomide, after numerous assurances that it was completely safe, gave birth to severely deformed children.

In the late 1970s when controversy was raging in the U.S. over the continued use of a dioxin-contaminated herbicide, 2,4,5-T, five laboratories were asked to measure the dioxin in deliberately spiked meat and milk samples. The results indicated considerable variation between laboratories, with Dow, a leading producer of 2,4,5-T, showing the least accurate measurements. More recently, irregularities in the test results produced by a private firm, Industrial BioTest Laboratories, have led to a review of an estimated 1100 studies of 113 pesticides. Health and Welfare Canada, which is sharing the review process, has found that many of the studies are invalid due to incompetence, carelessness or outright falsification.[129]

Heavy reliance on data from industrial producers and contract testing laboratories is standard procedure in Canada. Although guidelines for good laboratory practices have been introduced in the U.S. and are suggested for Canada, the limitations of this system are still an obvious cause for concern. While many laboratories maintain a credible distance from the industries they serve, as one report notes "a system that makes the fox responsible for counting the chickens leaves much to be desired".[130]

Workers: The Involuntary Experimental Subjects

The wisest approach is clearly one that emphasizes prevention and cooperation; however, this is seldom the direction taken in dealing with worker health and safety. Once substances widely used in the workplace have demonstrated their mutagenic, teratogenic or carcinogenic effect in non-human test systems, there is a distinct possibility of hazard to the human species. The frequently-raised question is whether our Canadian workforce provides the basis for the human experimentation commonly assumed to be unavailable to our scientific community and unacceptable to our public.

Epidemiological studies, studies that examine the prevalence of disease among general or specific human populations, are useful for assessing trends or associations. To determine the effect of workplace environments, groups of exposed workers may be compared with a group taken from the general population or with a group of workers in another type of workplace. Such studies draw from a variety of data sources; occupational, medical, residential and lifestyle histories are compiled, analyzed and interrelated in an attempt to establish disease patterns and to determine the cause of ill-health. In attempts to identify reproductive hazards, groups of workers may be compared to see if one group has experienced a greater number of miscarriages, stillbirths, or offspring with birth defects.

The unfortunate aspect of such studies is that they are carried out "after the fact", after large portions of the work population have lost their health or affected their offspring. According to Lloyd Tataryn:

> *Today, people who work and live in contaminated environments serve as early warning systems for toxic substances, much like the ancient royal food tasters and the canaries the coal miners once trundled underground to test the air. Workers and those who live in the shadow of polluting industries are the first people to encounter intense and prolonged exposure to toxic wastes. Much of what is known about environmental health and the consequences of exposure to poisonous and cancer-causing materials has been learned from examining disease patterns among workers and exposed populations.*[131]

Asbestos is one well-known example of this phenomenon. Experiences with reproductive hazards such as the pesticide DBCP have also supported this view; male workers after exposure to this substance found that they were sterile.[132] A study of Quebec children who died of cancer before age five made a significant contribution to the scant literature on paternal exposure when it revealed that many of the fathers had occupations involving hydrocarbons.[133] Rather than waiting for human experimental subjects to reveal the effects, surely strong measures to control the hazard before the damage is done are the best approach. Caution on the side of the worker, on the side of the human population, would be the more acceptable direction.

OCCUPATIONAL HEALTH AND THE COMMUNITY

As the preceding discussion pointed out, occupational health issues cannot be separated from the broader social issues affecting our whole society. Society not only bears the costs and some of the responsibility for worker health, it may also unwittingly be a victim of the hazards present in workplaces across the country. Workplace pollutants often

spill over into surrounding neighbourhoods. Lead, asbestos, radiation, and pesticides are but a few of the hazards that have been the subject of public outcries about their effect on the environment. Because of this, in addition to protecting workers from adverse conditions, occupational health measures must ensure the health of the larger community, those who may be affected outside the workplace.

People and Poisons: Beyond the Workplace

A recent Canadian report on environmental contamination discusses many of the problems of identifying hazards and pretesting industrial chemicals, and also establishes the important link between occupational health and the health of the general environment. The report, *Ecotoxicity: Responsibilities and Opportunities*, points out that industrial development, with its accompanying production, use, and discard of chemicals, has been actively encouraged in this country with little regard for the way such processes affect the health of either individual workers or the whole ecosystem.[134]

The much publicized Love Canal incident near Niagara, New York, is just one example of a situation where workers were exposed to poisons inside an industrial establishment and where the community eventually suffered side effects from the chemical wastes. The Love Canal case has relevance for Canada as well. A survey by the Ontario Ministry of the Environment revealed that as many as 800 such chemical dumps exist in Southern Ontario alone. At least one of them, in Hamilton, has been linked with a high incidence of health problems, including miscarriage and cancer, among the residents living near the dump site.[135]

Other situations in Canada — chlorine gas leaking from derailed tanker cars at Mississauga, Ontario and 12,000 gallons of liquid vinyl chloride monomer spilling onto the snow and into the air at MacGregor, Manitoba — emphasize the potential dangers. In both cases, workers and spectators on and near the particular site were exposed to dangerously high levels of the chemicals and suffered adverse affects. In similar instances, high asbestos levels inside plants have resulted in illness for family members exposed to contaminated clothing while lead levels near foundries and smelters have resulted in exposure above the threshold levels commonly accepted for children.[136]

Robert Sass is among those who caution against the growing tendency to consider occupational health concerns as a mere sub-category of environmental or public health.[137] As he points out, an overemphasis in the past on the public health needs of the upper and middle classes fostered attempts to simply confine diseases and hazardous conditions in the workplace rather than to eliminate them at source. Sass sees a parallel situation developing in the area of environmental pollution:

Many environmentalists want a safe environment, but still desire the fruits of modern technology. This sort of perspective and current public health priorities could again lead to the enclosure of hazardous situations and substances within the confines of the workplace and therefore, provide little or no protection for workers.[138]

He suggests that positive health benefits for society at large will only come when attentions are directed to the source of the hazards, the industrial process that creates them.

V

WHAT'S BEING DONE, WHAT CAN BE DONE?

In Canada as in other parts of the world, the 1970s produced some major commitments by all levels of people interested in the health and safety of workers. Research, reorganization, regulations and continuous debate were part of the process. All groups — government, management and labour — were participants. Much of the interest and the information was generated outside Canada: in the United Kingdom, in Sweden, in the United States, at the International Labour Office. Most of these early international activities as well as the Canadian initiatives have been reviewed in other documents.[139]

In the latter part of the decade, international and national attention focused with increased frequency on occupational health issues related to reproductive hazards. The underlying impetus seems inevitably to have been the risks faced by pregnant women in industry. The discussion centred around whether or not women of childbearing

capacity need to be protected from workplaces that pose dangers for healthy fetal development.

Preceding chapters have reviewed some of the issues surrounding reproductive hazards in Canada and how they have arisen. This chapter looks briefly at the way other countries have addressed reproductive concerns and also provides a preliminary analysis of the effectiveness of certain actions undertaken by various Canadian groups. In particular, it suggests some initiatives that could be undertaken by workers aiming for greater cooperation from employers and government.

INTERNATIONAL FOCUS ON REPRODUCTIVE HEALTH

In the United Kingdom, increased attention to reproductive hazards resulted in a government report issued from the Equal Opportunities Commission (EOC) in March, 1979. This document, called *Health and Safety Legislation: Should we distinguish between men and women?*, presented a comprehensive and detailed assessment of the current protective legislation and its effect on both sexes.[140]

The Working Party of Commissioners heard evidence from a wide range of organizations and industries, employers and employees. They reviewed legislation from many other countries, including France, Norway, Hungary, Czechoslovakia, and the United States. They commissioned a national survey to explore the attitudes and intentions of women who might be affected by changes to existing protective legislation. They consulted with the Health and Safety Commission, which has responsibility to make proposals for legislative change to the British government. With all this data to draw on, they made recommendations on hours of work, rest and meal breaks, the baking industry, the pottery industry, employment in mines and quarries, the handling of heavy weights, exposure to ionizing radiation and lead, and other factors affecting the full employment of women.

For all situations, their underlying argument was that existing legislation, which allows different treatment for men and women, should be replaced by legislation ensuring equal treatment. They presented two options — repeal the existing legislation that applies solely to women or extend this protective legislation to male workers. They rejected any age-based definition of reproductive capacity (eg., women between the ages of 15 and 44) and strongly recommended that, where possible, the maximum permissible exposure limits be lowered for all workers to the one currently applied to women of reproductive capacity.

In the United States as well, the latter part of the decade brought

increased national attention to the occupational health of working women. In 1976, the National Institute for Occupational Safety and Health (NIOSH) awarded a contract to the American College of Obstetricians and Gynecologists to study the problematic decisions for physicians attending pregnant workers. In 1977, the research report, *Guidelines on Pregnancy and Work*, was issued by NIOSH; it was followed in 1978 by a *Comprehensive Bibliography on Pregnancy and Work*.[141]

In February, 1980, the U.S. Equal Employment Opportunity Commission and the Department of Labor's Office of Federal Contract Compliance Programs issued a joint statement called "Interpretative Guidelines on Employment Discrimination and Reproductive Hazards". The proposed guidelines were issued in response to:

> *the increasing number of employers and contractors who are initiating policies excluding all women of childbearing capacity from certain jobs because of exposure to hazardous substances or conditions.*[142]

The two agencies noted that as many as 20 million jobs may involve exposure in the workplace to alleged reproductive hazards. They emphasized that policies, practices or plans to protect employees from reproductive hazards must not exclude on the basis of sex but rather must aim to protect all employees. They pointed out that the *bona fide* occupational qualification does not apply in those situations where the ability to perform the duties of the job is not in question. They established, within the proposed guidelines, eight stringent tests for determining the so-called neutrality of an employer's policy. The proposed rules would permit the temporary emergency exclusion of women or men where there is "evidence that a workplace hazard causes or is likely to cause significant harm to the reproductive health of employees of one sex only, or of pregnant employees".[143]

In the Scandinavian countries and in the U.S.S.R., research findings followed by worker and government action have provided the model for change in other nations. Information initiated in these countries on the health effects of anaesthetic gases, on hormones, on vibration, on non-ionizing radiation has alerted others to carry out complementary research. Unfortunately, much of their work dealing with reproductive hazards is inaccessible to researchers until translated. Legislative changes, particularly in the Nordic countries, have also been viewed with considerable interest. In Sweden, the adoption of the Working Environment Acts of the 1970s, based on the principle of protection for all workers according to their special needs, was a positive advance.

Although much of the testing for hazards in these countries has considered the effect on male reproductive ability, the primary focus has been on pregnant women. In 1977 in Denmark, the all-female

Women Workers' Union and the predominately male General Workers' Union together with the Equality Council and the Labour Inspectorate set out to rectify a perceived imbalance of knowledge regarding the way certain substances affect men and women. Their major aim was to dispel the ongoing argument that women, because of biological differences, need special protection.[144]

Many countries in Eastern Europe and the Soviet Union accept the principle of special protection for women, but the State is expected to bear the responsibility for ensuring that women excluded from jobs do not suffer any loss by the action. Thus, women at risk in one job are to be retrained before transfer to new jobs and places of employment. During retraining, the women retain seniority and pay levels and in the new job, their previous experience and qualifications are to be considered for any promotions.[145]

CANADA AND THE REPRODUCTIVE HEALTH OF WORKERS

In Canada, a number of organizational, scientific and social changes have resulted in a broader forum for health and safety issues in general, as well as encouraging increased attention to reproductive hazards. The recognition that workplaces must be designed to provide protection for all workers has led to stronger legislation, new research and greater cooperative efforts between the interested parties. While the future is far from rosy, many of the directions taken have been positive ones for workers. The following discussion outlines a few of the things being done to address the impediments to healthy and safe workplaces and indicates additional steps that must be taken.

Dealing With Exclusionary Policies

Current legislation, including the Canadian Human Rights Act, the ten provincial Human Rights Acts, and the two territorial Fair Practices Ordinances, prohibits discrimination in employment on the grounds of sex as well as on the basis of race, religion and various other factors. As noted earlier, the increased incidence of policies excluding women from certain jobs indicates that this legislation does not wield enough clout to ensure the desired equality for female workers.

The need to further define "discrimination on the basis of sex" to include aspects of reproductive physiology has been noted by several groups. In a June 1980 position paper on reproductive hazards, the Canadian Advisory Council on the Status of Women recommended to the federal government that the relevant legislation relating to the employment of women be strengthened by the following amendment:

> *to prevent discrimination in hiring, job placement, promotion and other conditions of employment based on factors related to reproduc-*

tive physiology, such as reproductive capacity, pregnancy or childbirth.[146]

Other groups at the government level have addressed the problem of reproductive hazards and particularly their impact on the employment of female workers. In 1979, a working group composed of representatives of various provincial departments involved in health and safety as well as federal delegates from Health and Welfare Canada was appointed to set up specific guidelines to control risks for women in industry. After consultation with various groups such as provincial and federal human rights commissions, status of women councils, medical associations and various labour and management organizations, this sub-group of the Federal-Provincial Advisory Committee on Occupational and Environmental Health outlined the multiple problems to be addressed and advocated that the issue needed concerted action by provincial groups.[147]

To date, only Ontario and Quebec appear to have actively considered this issue. In 1977, the Ontario Advisory Council on Occupational and Environmental Health submitted a report called "Occupational Hazard to the Fetus in the Case of Pregnant Women in the Workplace" to the Ontario Minister of Labour. In summarizing their findings, they recognized the problems for male workers as well as pregnant women:

> *It may be concluded that the identification of the nature and quantity of agents potentially harmful to the fetus has been sadly neglected. Such agents have usually been discovered by accident. Since the agents may affect the fetus when either parent is exposed, it is clear that the easy solution of not exposing the potential or pregnant mother is not the answer...*[148]

In 1980, the recently established Ontario Advisory Council on Occupational Health and Occupational Safety set up a Task Force on Women and Occupational Health and Safety. Among its terms of reference, it has the authority "to review the occupational health and safety problems of women at work, to examine the issue of susceptibility, to examine existing standards and procedures to see if they take into account the special needs, if any, of women".[149] The Task Force's report, scheduled for publication in 1982, could be used by the Ontario government to establish clear guidelines that might help in the resolution of specific cases of discrimination related to reproductive hazards.

The Quebec government, on the other hand, focused on reproductive hazards in their provincial health and safety act passed in 1979.[150] The right of pregnant and nursing workers to be assigned away from work areas posing a physical danger to the worker, the fetus and the

newborn child is a significant step. Legislation must, however, move beyond its present concentration on maternity issues to address the hazards facing fertile employees of both sexes and the issue of employment policies that prohibit the hiring of women because of childbearing capacity.

Workers have taken their own steps to force legislators and employers to rectify discriminatory situations. The exclusion of women from the Flin Flon smelter in northern Manitoba brought strong action from the local union, which proceeded to file a complaint with the Manitoba Human Rights Commission. The Flin Flon local of the United Steelworkers of America claimed that the policies of the Hudson Bay Mining and Smelting Company discriminated against male workers by allowing them to be exposed to dangerously high lead levels. The case moved from the provincial human rights commission to the federal one, where it is currently under review.[151]

The hiring policy of General Motors at Oshawa has been argued in two forums. In 1976, the women who were transferred out of the battery division filed a complaint with the Ontario Human Rights Commission which eventually dismissed the case. In 1979, the United Auto Workers union unsuccessfully took the case to the Ontario Office of Arbitration. However, in the ruling, the arbitrator opened the door for yet another case based, not on the discrimination against women who are excluded from lead exposure jobs, but on the potential harm to fertile men who are left to work in areas contaminated with lead.[152]

The need to challenge differing standards for male and female workers is evident. In situations where risk is known to exist for all workers, legislation must ensure that everyone is protected. Occupational health and safety standards setting out permissible levels of exposure to workplace hazards should aim at securing maximum protection with no distinctions on the basis of sex. Workplace legislation needs to address both the health issues and the equal rights issues and must guard against measures that simply win for female workers "an equal right to be poisoned".

Both female workers facing exclusion and male workers left facing the hazards may find themselves involved in a lengthy and aggressive campaign to draw attention to their situation. Knowledge about one's rights is an essential first step to combatting discriminatory hiring policies and discriminatory regulations and in this area, workers can find union and/or government resource people to help explore the legislation pertinent to their specific work situation.

Many avenues can be tried to ensure that a particular case and the offending workplace and/or health standards receive full attention. These might include: filing a complaint with the relevant human rights

body; using the grievance procedure, particularly if the collective agreement has a non-discrimination clause; writing elected representatives at the provincial, territorial or federal level. In addition, it is useful to alert government officials to the value of stimulating activity within the legislative system and to seek out all possible support groups including unions, women's organizations, and advocacy associations concerned about worker rights and conditions of labour. Workers who have difficulty getting action or positive support will find that contact with the media — newspaper, television, radio, magazines — can often be a valuable route for getting both coverage and action.

"If low-level radiation is so safe, why are the bosses' offices so far away?"

Ensuring Health and Safety as a Right for all Workers

During the seventies, formally recognized mechanisms for worker participation in health and safety discussions gradually became more commonplace across Canada. Saskatchewan provided the model for much of the health and safety legislation relating to worker rights and continues to have one of the best records for enforcing its workplace laws. Joint worker/employer health and safety committees are now mandatory in many jurisdictions. The right of a worker to refuse dangerous work is also acknowledged in the laws of the federal government and most provincial governments.

Legislation such as Quebec's Bill 17 on health and safety gives additional hope to those concerned for worker rights. The stated intent of the 1979 bill is "to provide mechanisms for the participation of workers and employers in the elimination of the causes of occupational accidents and occupational diseases".[153] Based on the right of every worker to working conditions that show proper regard for her or his health, safety and physical well-being, the legislation brought increased responsibilities for the public health network, the right to refuse work for the worker, and joint health and safety committees for both workers and employers. A new government agency was created to administer the legislation.

As mentioned earlier, the Quebec bill was the first in Canada to give particular attention to the pregnant worker, ensuring her "the benefit of reassignment where her working conditions involve physical danger for her unborn child, or for herself due to her pregnancy". The reassignment must be made by the employer immediately on receipt of a medical certificate and, if it is not, the pregnant worker may cease to work and will be compensated until the date on which she is entitled to maternity leave. The compensation, based on 90 per cent of the woman's net earnings, is to be paid by La Commission de la santé et de la sécurité du travail. Similar terms could apply to a worker who is breast-feeding an infant.

This move by the Quebec government opens the door to the possibility that pregnant women may in the future receive disability benefits and sick leave on the same basis as fellow employees unable to work for other reasons related to physical conditions. It represents a new step in the recognition of potentially disabling work-induced illness of a reproductive nature. However, limiting the assistance to pregnant and nursing women only suggests that the concern is more for damage to the fetus and newborn than for the ill-effects on the female worker. The harm done to the reproductive functioning of male workers and to non-pregnant women, some of it irreversible, is not considered.

Improvements in workplace legislation have often been the result of unremitting political lobbying and educational tactics by labour organizations. Many unions have devoted legal, monetary and research resources to the business of improved health and safety for workers. The Canadian Labour Congress, the largest of the central labour bodies, has an active occupational health and safety division providing assistance in the collection of information, the development of printed and visual educational material and the teaching of courses on worker health concerns.

Most of the ten provincial Federations of Labour (the provincial organizations of the Canadian Labour Congress) have advisory committees focusing on health and safety issues; several have full time staff

persons responding to the needs of their union membership. At the Ontario Federation of Labour, funding from the Ontario government's lottery enabled them to establish training programs for health and safety instructors, to set up a resource centre providing basic information on toxic substances used in the workplace, and to develop a health and safety newsletter for improved communication with workers around Ontario.

In 1972, three of the four Quebec labour centrals — the Confederation of National Trade Unions (CNTU), the Quebec Teachers' Corporation (QTC), and the Quebec Federation of Labour (QFL) — united as the Common Front to bargain for 200,000 public sector workers, of which more than two-thirds are women. As a result of Common Front negotiations, these female workers were granted maternity health provisions in 1979 that were, later that same year, included in the Quebec government's Bill 17. The innovative aspects of this labour-initiated agreement included terms whereby employers were given the responsibility of informing pregnant workers of potential dangers to their health or that of a fetus and of working out compatible work transfers where required. In addition, if work changes were not deemed possible, the pregnant worker had the right to stop work and receive benefits.[154]

However, in spite of this activity by government and labour bodies, most workers are still forced to bargain for their health. Since reproductive health hazards have a particularly low priority, much of the impetus for change must come from the individuals closest to the problem. One mechanism for action at the workplace level is the organization of a committee made up solely of affected workers. Even when joint employee/employer committees are in effect, worker committees serve to mobilize larger numbers and a broader cross-section of those directly affected by workplace conditions. Once these committees are in place, they must have the right to carry out surveys of the workplace to document hazards, to circulate information pamphlets or newsletters to other workers, to teach workers to monitor hazards on an ongoing basis, and to pressure management for hazard control procedures. Unionized workers who can rely on their union for assistance in such undertakings have a definite advantage over non-unionized workers.

Joint worker/employer committees, now required by law in several provinces, have exhibited some degree of influence over work conditions. These committees would be more effective if they had ready access to government scientific, regulatory and enforcement information as well as to officials with the legal authority to penalize unheeding employers. The committees should have full knowledge of hazards, regulations, and monitoring procedures. When they identify

situations involving hazard, they must be able to exercise their right to stop work until the condition is amended. In addition, they need the authority to monitor and to enforce standards on a regular basis with strong protection against penalty for their decisions.

In addition to effective representation on workplace committees, workers should have the right to a full disclosure of information on hazards in the workplace. This "openness" policy must extend to government research, environmental testing, inspection reports, medical tests as well as manufacturers' reports on toxic substances. When a risk to their general or their reproductive health is identified, workers must have the right to refuse work. When they exercise this right, they need to know that they can do so without fear of penalty and without the need to secure extensive legal or medical advice prior to the action.

Before such rights can have much effect on the workplace and on hazardous conditions, workers must know that the rights exist and how to exercise them in resolving reproductive health concerns. Unions can play a key role in emphasizing the basic legal rights pertinent to health and safety, in ensuring that collective bargaining language is strong, and in educating workers on all avenues for seeking redress.

Changing the Scientific Direction

In April 1978, the Canadian House of Commons passed Bill C-35, an Act to establish the Canadian Centre for Occupational Health and Safety (CCOHS). Operating out of Hamilton, Ontario, the Centre, an independent, self-governing body with a multipartite council of government, labour and management, is not part of any federal government department or agency but does report to Parliament through the Minister of Labour. Its basic purpose is "to promote, through cooperative activity, joint planning and the dissemination of information, the physical and mental well-being of Canadians at work".[155]

The principal task of the CCOHS is the development of an information and advisory service. The basis of this service will be a system of electronic information networks and data bases that will provide information for use by the working people of Canada. The system will initially contain data on the nature and harmful properties of chemical substances and will suggest procedures for storage, handling, use, detection, control, emergencies and personal safety precautions. The intent is for workers to be able to access the system by a local telephone call to any of the approximately one hundred data terminals to be installed across the country. The system will eventually match information on chemical and physical hazards to the relevant Canadian laws and regulations. The potential for such an information base is

enormous; it could be of particular value to non-unionized workers who lack ready access to a data base or other resources that organized labour groups can offer.

To date, considerable interest has been generated by the opening of the Hamilton office and the flow of inquiries has been increasing steadily. In his second report to the Centre's Council in May, 1980, the president listed some headings illustrative of the subject matter of the inquiries. Three were specifically related to the concern over reproductive health: toxic and physical hazards to pregnant women, the legal rights of pregnant employees in Ontario and Quebec, and the issue of discrimination against women excluded from certain jobs for reasons of health protection.[156] Many other inquiries focused on specific hazards or specific workplaces relevant to this issue: formulation of regulations to protect health care workers, chromosome analysis, electrical workers' exposure to chemical hazards, paint stripper as a hazard, correction fluid poisoning, ozone and photochemical oxidants.

The CCOHS, which has among its other powers the right to "promote, assist, initiate and evaluate research",[157] could play a major role in ensuring that projects related to reproductive hazards affecting male and female workers are undertaken and appraised on an ongoing basis. Considering the clearly evident need to identify all such hazards and their effects, to develop ways of monitoring their presence in the workplace and to eliminate the adverse effects on all workers and their families, the Centre could provide the impetus for major work across Canada. While Canada currently relies heavily on the United States and to a lesser degree the United Kingdom for such information, a great deal of the relevant research has been carried out by countries in eastern Europe. The responsibility for collection, translation and analysis of data on reproductive hazards from Polish, German, Russian or other scientists in Europe or Asia could perhaps be assumed by the Centre.

The establishment of the Canadian Centre for Occupational Health and Safety was a major step toward national recognition of health and safety concerns. However, along with information and advice, Canadian workers need significant changes within the scientific research community, at the institutions promoting health education, at the standard-setting, regulatory and enforcement levels. Researchers, physicians, toxicologists, engineers, industrial hygienists and others concerned with health and safety must assume greater responsibility for promoting and maintaining healthy work conditions and healthy workers.

In Quebec, some significant steps in this direction have already been taken by geneticists, audiologists, physicians, and others concerned at the gap between workers and professionals in the scientific and medi-

cal spheres. For example, at the Université du Québec à Montréal and the Université de Montréal, efforts are being made to utilize the available human and physical resources to undertake research and to prepare information guides needed by workers in their efforts to deal with health and safety concerns across the province.[158]

Some of the most immediate needs are for standards that will ensure maximum protection for any worker susceptible to reproductive hazards; public access to all information on standard-setting; pretesting methods that automatically include screening for teratogenicity, mutagenicity and carcinogenicity; the elimination or significant alteration of jobs with known reproductive hazards through the substitution of substances or through mechanical redesign such as separate air supplies or mechanical handling devices. In addition, all health professionals should receive some training in occupational health; more specialized courses on reproductive hazards should be compulsory for those planning to be full time occupational health professionals. To ensure that the attention of the scientific community is directed to the question of reproductive hazards, increased funds specifically allocated for research, for training, and for information materials on reproductive health are essential.

Linking the Workplace and Community

Meetings between worker organizations and community and environmental groups, where information and resources are exchanged, provide an important forum for discussing the way that workplace health issues are intimately related to general environmental hazards and to the health concerns of the total community. Without some mechanism for voicing what are often shared concerns, occupational and environmental health groups may find themselves duplicating each others' efforts or competing for limited resources and funds.

In at least one province, workers have taken further steps toward greater participation in health and safety through local community-based initiatives. In Windsor, a highly industrialized Ontario city, the fight for the right to a safe workplace led various groups of workers to band together and develop the Windsor Occupational Safety and Health Council (WOSH). The Council, established in the fall of 1979 on a city-wide basis by rank-and-file unionists from a variety of industries, was the first such organization in Canada.[159] Prior to the formation of this united front, the workers and their union health and safety representatives had worked in isolation, receiving complaints, compiling information, and doing research on a plant-by-plant basis. One of their first moves was to call a public meeting to alert Windsor citizens to their concerns and to point out the impact on the whole community.

Several of the issues that WOSH has been tackling are relevant to the reproductive health of both workers and residents in the surrounding areas. At the Wyeth Limited plant, where birth control pills and tranquilizers are produced, female workers have reported irregular menstruation and infertility while male workers report enlarged breasts and impotence.[160] At the Canadian Rock Salt Mine, diesel emissions from underground machinery cause serious short- and long-term problems for the miners. Among other problems, research indicates that diesel emissions may be carcinogenic and mutagenic.[161] At a small plastics factory in the city, workers have reported respiratory difficulties, headaches, nausea, severe nosebleeds, and loss of feeling in their hands. These problems were linked to the presence of vinyl chloride, a known reproductive hazard.[162]

Some worker groups assert that the right to refuse work must be extended to include hazards endangering the environment beyond the immediate worksite. At the Ontario Federation of Labour Conference in October, 1980, one of the workshops recommended that the right to refuse be extended to those in jobs where the work endangers people living in the vicinity of the workplace.[163] This idea could be extended to the right-to-know situation as well, so that citizens potentially affected by hazardous operations are informed about dangers near their homes.

Community-based groups concentrating on health and safety issues are crucial to forging the essential link between workplace ills and community ill-health caused by pollution. Public meetings, media coverage, joint information dissemination, active lobbying for a recognized role in decision making, cooperative endeavours to exert pressure on government officials or recalcitrant employers are an effective way to bring about rapid change on what are recognizably mutual concerns.

VI

THE WORK HAS JUST BEGUN

Regardless of the good intent of groups focusing on reproductive hazards, the current efforts to promote change have fallen short. Workers across Canada continue to assume the major cost of work-places rendered unhealthy and unsafe by the incessant demands for industrial development, increased corporate profits, and expanded production. The increase in exclusionary employment policies means that women are denied jobs that pay a decent wage and are forced into unemployment or low paying and often hazardous work, while men are left to work in conditions that impair both their general and their

reproductive health. Thus, all workers pay the price of unemployment, work-induced illness, and/or defective children. Their right to a healthy and safe working environment is overlooked.

Working people and their families stand to gain the most if health and safety improvements are effected immediately and to lose the most if their exposure to unhealthy conditions continues. Working men and women are seldom in a position to make choices about reducing workplace exposure before their health is impaired. The necessity for paid employment and the lack of strong rights at work diminish their negotiating power. Although some groups of workers can rely on a strong union to lobby for their right to maintain good health, the majority face an extremely difficult task in forcing change in the workplace. Workers who are not unionized or who belong to smaller unions, immigrant workers, workers in single-industry towns, new workers, temporary workers, and migrant workers may be particularly vulnerable.

Canadians across the country must wake up to the need for greater cooperation and increased activity to prevent adverse effects on future generations. Governments must seek new ways to simplify the jurisdictional jungle surrounding occupational health and safety legislation and must ensure that any laws already in place are constantly enforced. Employers, scientists and occupational health specialists must use new pretesting methods for the early detection of hazards and must implement the technological change needed to clean up the workplace and to prevent environmental pollution. Workers must participate in decisions that affect their health on the job, must have access to any information needed to effect change, and must be able to refuse work that endangers their well-being.

More awareness of the adverse effect of occupational exposure on reproductive outcome is vital. The narrow approach, which emphasizes only the role of the mother and focuses primarily on negative lifestyle factors, ignores both the enormous impact of the hazards of work and the reproductive role of the male partner. It is time for the invisible reproductive effects of occupational hazards — the twisted sperms, damaged chromosomes, defective ova, reproductive cancers — to be recorded and linked with their cause.

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   In addition, a paper written in French by Karen Al-Aidroos gives simple explanations of terms like mutagenesis and teratogenesis. Titled "Est-ce qu'on protège la travailleuse enceinte au Québec?", the paper can be obtained from the author at the Departement des Sciences biologiques, Université du Québec à Montréal.

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APPENDIX A

Employment by Industry[a]

Industry	Male	Female	Both Sexes
All Industries	6,287	4,371	10,658
Goods-Producing Industries	2,588	741	3,329
Agriculture	322	111	433
Other Primary Industries:	257	30	287
Forestry	55	4	59
Fishing and Trapping	27	...[b]	28
Mines, Quarries and Oil Wells	175	25	200
Manufacturing	1,456	543	2,000
Construction	553	57	610
Service-Producing Industries	3,699	3,630	7,329
Transportation, Communications and Other Utilities:	686	201	887
Transportation and Communication	586	184	770
Electric Power, Gas and Water Utilities	100	17	117
Trade	1,074	826	1,900
Finance, Insurance and Real Estate	231	364	595
Community, Business and Personal Service	1,244	1,968	3,212
Public Administration	464	271	735

[a] Figures in thousands
[b] Not appropriate or not applicable

Source: Statistics Canada, *The Labour Force, December 1981*. Ottawa: Supply and Services Canada, 1982. Cat. No. 71-001, Table 22, p. 45.

APPENDIX B

Employment by Occupation[a]

Occupation	Male	Female	Both Sexes
All Occupations	6,287	4,371	10,658
Managerial, Administrative	620	257	877
Natural Sciences	334	57	391
Social Sciences	79	80	159
Religion	21	...[b]	23
Teaching	186	278	464
Medicine and Health	120	377	497
Artistic and Recreational	96	59	155
Clerical	417	1,491	1,907
Sales	695	466	1,161
Service	654	792	1,446
Agriculture	338	99	438
Fishing, Hunting, Trapping	25	...	26
Forestry and Logging	46	...	47
Mining and Quarrying	76	...	77
Processing	291	60	351
Machining	243	12	256
Product Fabricating, Assembling and Repairing	730	222	953
Construction Trades	607	8	615
Transport Equipment Operation	371	29	401
Materials Handling	223	53	276
Other Crafts and Equipment Operating	115	24	139

[a] Figures in thousands.
[b] Not appropriate or not applicable.

Source: same as Appendix A

PHOTO CREDITS
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